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WORLD CROPS

The International Journal of Agriculture

VOLUME 13, No. 9 SEPTEMBER 1961

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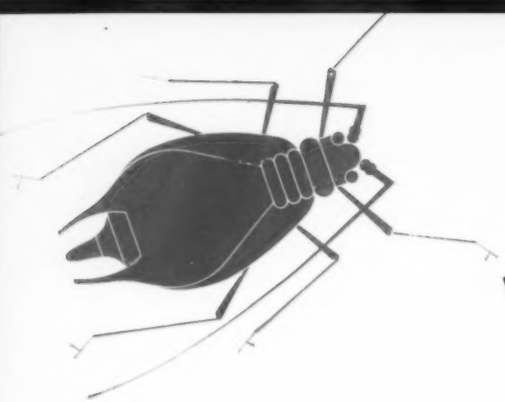

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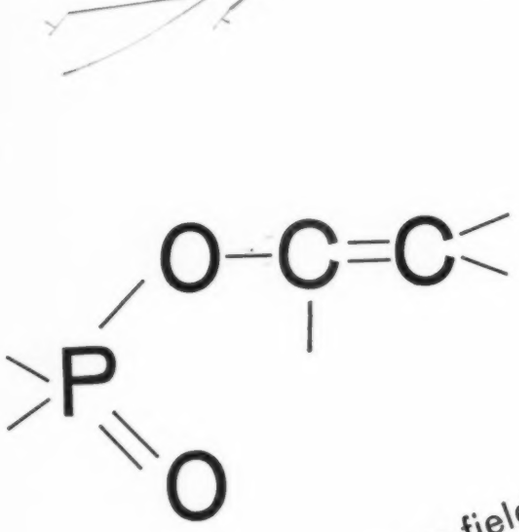

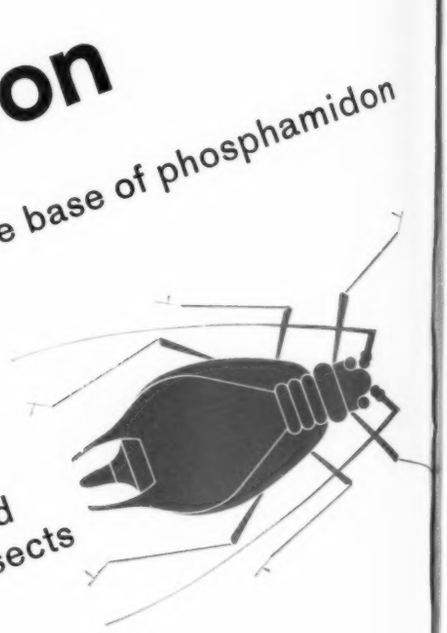

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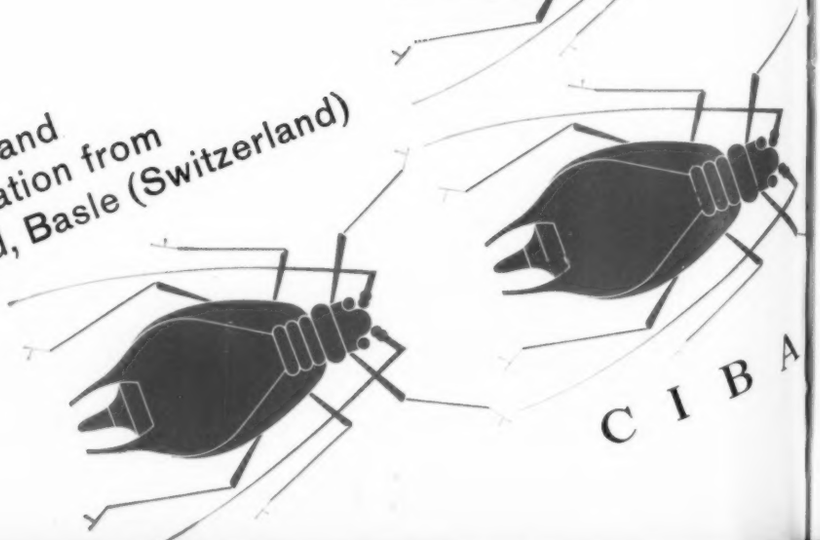

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WORLD CROPS

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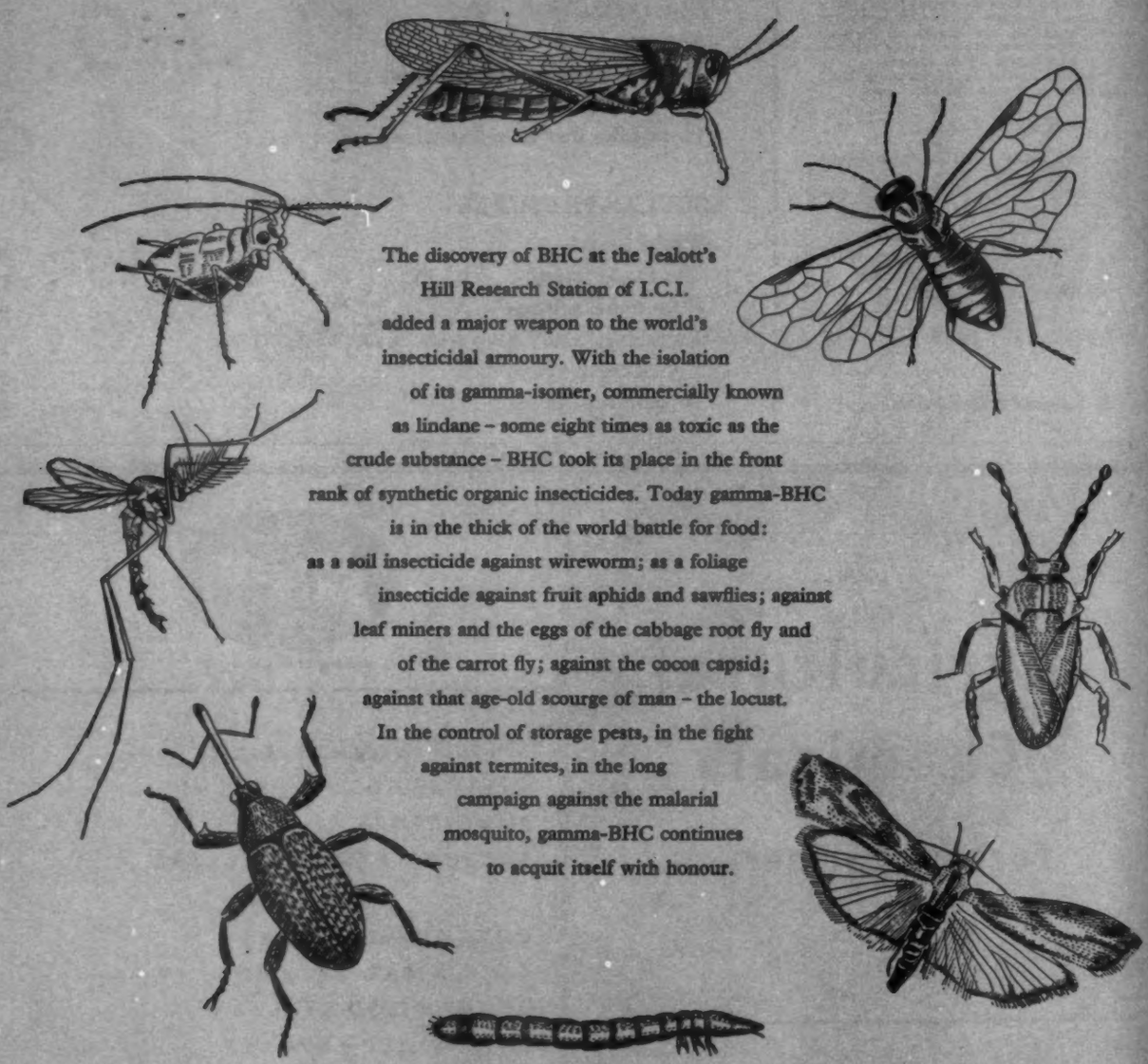
BETTER HARVESTS ROUND THE WORLD

BHC: England: 1943



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Editorial Comment

Aerial Farming

THIS ISSUE OF WORLD CROPS deals with various aspects of the use of aircraft in developing world agriculture—aerial mapping of existing land use and for the surveying of new areas; the economics of the use of aircraft in agriculture; and the special problem of crop protection and pest control from the air.

The extent to which they are used calls for a better understanding of the possibilities and limitations of this important new branch of mechanised farming. There is also a need for a greater sense of responsibility in contracting—for reckless price-cutting will not improve the status of this new industry and may jeopardise its future. If plant and machines are neglected to cut costs, breakdowns and faulty spraying will be inevitable and flying accidents may occur. The farmer, having once been let down and perhaps lost his crop through a breakdown and accidents, will revert to the use of ground machines and it will be difficult, if not impossible, to restore his confidence again.

Dr. W. J. Maan, the Director of the International Aviation Centre at The Hague, strongly urges that in every country where aerial farming may be practised there should be a competent overall body to regulate and control the industry so that it can develop along the right lines for the benefit of all concerned.

The Soviet Exhibition

AS WE GO TO PRESS the Soviet Exhibition is opening at Earls Court in London. Staged as a 'return match' for the very successful British Trade Fair in Moscow last May, this three-week exhibition is something very different from an ordinary trade fair. It is, indeed, more—a triumph of propaganda and publicity.

The vast expanse—250,000 sq. ft.—has been completely redesigned to accommodate the 22 halls which present various aspects of the Soviety economy. From the moment that we entered the exhibition building to be confronted by a jovial Mr. Khrushchev we felt ourselves to be in quite another world. The fact that £1 million was spent on staging this impressive exhibition is sufficient evidence of the importance that the Russian Government attaches to acquainting the British people with the magnificent achievements of their men of science and of the sacrifices of the people to the Cause.

But throughout the exhibition is more concerned with the promotion of external trade for Russia, not so much in its traditional raw materials—minerals, timber, fish, wheat, cotton and other agricultural products—as in manufactured goods from furs to farm machines. There was, for instance, a mighty mechanical coal cutter which proudly bore the notice: 'Sold to the British Coal Board'.

This is all to the good, as the future peace of the world hinges largely on the steady expansion of world trade and the promotion of trade between countries to meet the increasing needs of increasing populations so as to raise and maintain the standard of living of all peoples.

Ballyhoo

From the moment one entered the exhibition one was drenched with propaganda and brain-washed with almost meaningless statistics and slogans, and subjected to a welter of conflicting thoughts which gave one no time to think or concentrate on one idea at a time. One was overwhelmed by the massive sculptures, the vast panoramic photographs, the 15 side-by-side cinema screens, each showing a different film, the simultaneous projection of five different 'space fiction' films in the Hall of the Cosmos to the accompaniment of weird space music, and everywhere power and still more power.

In fact, the exhibition tried too hard to impress; nevertheless, the overall effect was considerable. Even the obvious transparency of so much of the propaganda failed to destroy its impact on the young, the emotional and the unthinking. For instance in an impressive 94-page booklet—'Soviet Man in Space'—the names of the witnesses and the exact time, place and method of the landing are deliberately omitted. No world athletic record would be accepted on such flimsy 'evidence'. There was terrific over-emphasis on the Space Age and yet a totally inadequate agricultural section.

The underlying theme of the exhibition was PEACE, PEACE, PEACE and the need for peaceful co-existence, while all the while there is being fostered a cold economic war of destruction to impose the Communist way of life on the ruins of our 20th-century civilisation, which, though not perfect, nevertheless works.

Inconspicuously in a remote corner of the exhibition an elderly Russian lady was presiding over a visitors' book of commentary, which we carefully examined. The question was 'What do you think of the exhibition?' It was apparent that nine out of ten were being converted to Communism through this one small exhibition. Typical was the comment of a visitor from India, who considered that the mighty achievements of the U.S.S.R. were far in advance of anything that the Western countries could show.

Perhaps the most constructive lesson to be learned from the exhibition is the need for dedication to a cause in the face of economic calamity and adversity. It was moving to see the ruins of Stalingrad and what the city has become today. We think it is this which will appeal to our young people when the ballyhoo is all forgotten.

Agriculture in Russia

This section was disappointing and this may perhaps be due to over-concentration on the Space Race. The emphasis throughout the exhibition was on the highly technical and the industrial; here in agricultural machinery it was on weight and sturdy construction.

There was a tractor-drawn two-wheeled potato harvester of heavy tubular construction which weighs over 4 tons, a cotton-harvesting machine to be drawn behind a 42-h.p. tractor and yet weighed nearly 6 tons, and a maize-harvesting combine designed to harvest three rows at a time, weighing about 2 tons.

The passage of such massive machines over the ground is bound to lead to soil consolidation and panning after a few years, yet no implement was shown for subsoil or underground cultivation. Examples of machines for surface cultivation were a sturdy four-furrow 10-in. plough for mounting on the three-point linkage of the tractor and some simple chisel cultivators.

Small seeding and fertilising machines were shown, but there was no example of their 24-row seeding machines; nevertheless, it was explained that a 20-h.p. tractor will draw one of these machines, a 35-h.p. tractor can draw two side by side and an 80-h.p. tractor can take four and in this way is able to cover 200 acres in one day, an important point in view of the vast areas to be covered in the U.S.S.R.

Examples of small, medium and heavy tractors were also shown. These included the small 'Tracktop AT-20', an 18/20-h.p. single-cylinder model weighing 1½ tons; the 'Vladimiretz T-28', a four-cylinder diesel tractor with a 30-h.p. engine, which weighs 2½ tons, and 'The Caterpillar T-75', a diesel-engined machine of 75 h.p., which weighs 7 tons and is stated to have a tractive power of 3 tons.

Farm and Forest Products

On the agricultural side there was an assortment of farm and forest products, but nothing unusual or exceptional. There were the usual sheaves of wheat, oats and barley, a colourful display of hybrid maize, long-staple cotton, sheaves of flax for linseed and fibre, an average display of fruit, and a very ordinary display of pit props and wood pulp. One useful feature was the four pea varieties, two barley varieties, four maize varieties and seven varieties of wheat with samples of the derived flour.

In addition, there were slogans and statistics—masses of them—mainly to illustrate and emphasise the tremendous advance that has taken place through 'Socialism' since Czarist times. Of course! This is obvious and a natural corollary to the increase in rural population, the vast acreage of virgin land available for development and the mechanisation of agriculture. In no way, however, are the achievements in Russia to be compared with those of farmers in the U.S.A., where massive over-production of many commodities through the full application of modern methods has become almost uncontrollable.

We would have liked to have learned something new in this all-important section, but we learned precisely nothing. There was nothing about pest control, no spraying or dusting machines, no examples of modern systems of irrigation and nothing whatever about the use of the aeroplane in agriculture, which could be used in the wide open spaces of the U.S.S.R. to such good effect. There was nothing whatever about agricultural science and research in the U.S.S.R. It was what was *not* shown at this exhibition which is so significant.

Scientists' Who's Who

EIGHT YEARS AGO Leonard Hill Ltd. published 'Who's Who in British Science', the first directory of its kind. The names of over 3,000 leading scientists, with their personal and professional particulars, appeared in this unique book. It is now sold out and the publishers are repeatedly being asked when the next edition will appear. The answer is that it is unlikely to appear again as a private venture because it is too costly to produce at a price people are prepared to pay.

A directory of this kind is disproportionately expensive to produce because of the enormous amount of detailed labour it requires. Questionnaires have to be sent to thousands of scientists and it may be months or even a year before they are returned. The questionnaires have to be edited and then a proof of each entry has to be submitted to the person concerned. Corrections are usually prolific because personal details, such as address, appointment, scientific honours etc. can change considerably in a period of months. Not until every proof is returned and every correction made can the directory appear.

'Who's Who in British Science' is a directory that is really needed. It is of immense value to our scientists, universities, industries, educational authorities, ministries and the Press, and it is consulted regularly in under-developed countries seeking scientific and technical assistance. In this respect it helps to ensure that British scientists and British industry are not overlooked. There are repeated demands for a new edition, but it is simply not commercially feasible for a private publisher to undertake.

Leonard Hill Ltd. are prepared to collaborate with those willing to provide financial aid for the production of a new and larger edition. Learned societies, industrial firms, the universities and Government departments might well consider how they could help this urgently needed enterprise. It should prove possible to make financial arrangements to launch a second edition and succeeding editions on a regular basis. Individuals and organisations prepared to take an interest in 'Who's Who in British Science' are invited to communicate with Leonard Hill Ltd., Leonard Hill House, Eden Street, London, N.W.1.

Resources of the Earth

UNDER THE CHAIRMANSHIP of Dr. V. Kovda, of UNESCO, a group of nine of the world's leading soil scientists from the eight continental regions of the world, including the U.S.S.R., have recommended a working programme for the ultimate production of a soil map of the world, based on the results of large-scale regional soil surveys.

The group, having laid down the working principles, are to meet once a year to discuss and report on the progress of this important project, which it is hoped will lead eventually to the production of a soil resources map and will interpret the soil in terms of its potential agricultural production.

Planned Progress

The group includes representatives of FAO, UNESCO and the International Society of Soil Science and the overall co-ordination is being undertaken by Dr. R. Dudal at FAO headquarters in Rome. We learn that the project will be developed in stages with the preparation of the large-scale regional maps in the following sequence:

1962: Australia
1963: North America
South and Central America
Europe and Near East
1964: North and Central Asia
South and South-East Asia
Africa

Wild Optimism

It is hoped to be in a position to submit a series of continental maps to the next Congress of the I.S.S.S. to be held in Rumania in 1964 and to prepare the final draft of the world soil map in 1966 with a view to publication in 1968, *i.e.* in seven years.

We are even informed that these maps will also include environmental factors of importance to agriculture, such as land relief, degree of stoniness, valley bottoms in desert areas, the incidence of endemic diseases, and plant and animal deficiencies. Schematic, climatic and vegetation maps are to be included in the text of a loose-leaf atlas covering some 40 sheets and published in English, French, Spanish and Russian editions.

This is a tremendous undertaking—even more so because so much of the earth's surface is not mapped at all and because trained staff to carry out this work carefully and conscientiously is simply not available in most of the countries concerned.

—and Realism

It is all very well 'to set your sights high', but there are limits. To produce a misleading and unreliable soil map would only bring disrepute to all the organisations and individuals concerned and at enormous cost to the subscribing countries. We submit that to find men to do the detailed recording on the ground must mean robbing soil departments of the countries concerned at a time when these departments are heavily engaged in development projects for agriculture.

To carry out this vast project with alien staffs introduced from other countries would be prohibitively costly even if it were practicable and acceptable by the countries concerned—nor would it be entirely desirable.

Would not the year 2030—70 years hence—be a more realistic target for a complete Soil Map of the World, or have we to do everything in a hurry? Is there not an infinity of time for an infinity of progress? Rather let us progress slowly and surely, and do the job properly.

A Phoenix from the Ashes

THREE YEARS AGO, as reported in our March, 1958 issue, the Colonial Products Laboratories were moved from the old Imperial Institute—now no more—to a more modern and far better equipped suite of laboratories in the premises built on a huge bombed site in the City of London. The name of the organisation was changed to the Tropical Products Institute and its

Every farmer in the 1970s will have his own robot aerial sprayer.—London Evening Standard, 12 June, 1961

new function was to assist and advise the new countries in tropical and sub-tropical regions.

The 1960 Annual Report of this Institute reflects this change in policy in a significant expansion in its activities. There is a pronounced movement away from short-term investigations, involving the routine analysis of vegetable and mineral products, towards research on development problems and assistance to laboratories in these countries, for the bulk of the inquiries have concerned problems of processing, storage, packaging, marketing and shipment.

Even more important is the need for specialists to advise and assist them in their economic development and we are pleased to note that the Institute has sent visiting scientists to 39 countries and is also accepting men from overseas for training.

Revision and Re-Revision

MUCH CONCERN HAS BEEN expressed recently in Britain on the hazards to wild life arising from the use of chemicals. The agricultural chemical industry, in particular, has been criticised for introducing chemicals which, it is claimed, have caused large casualties amongst birds. We must never forget, however, that all concerned have additional responsibilities—land must be made to produce more food, not only in the U.K., but also in other countries, for the human population is increasing rapidly and, unfortunately, far too high a proportion of it is still too close to starvation.

Agricultural chemical manufacturers are only too well aware that they have a duty to see that the chemicals bringing about the increased food production do not, in turn, produce an undue hazard to birds and wild life. The search for safer chemicals, though difficult and costly, goes on unendingly, but with increasing success, though there are still some agricultural chemicals for which less toxic replacements have not yet been found. The manufacturers are convinced that even these can be handled and applied with safety to all, *provided the instructions on the labels are understood and carried out.*

Under the British Notification and Clearance Scheme an independent Government committee examines all the scientific information on the toxic chemicals, so that an assessment can be made of the potential hazards in the use of such chemicals and adequate precautions can be laid down for their general application if these are found to be necessary.

Obviously the position needs to be reviewed in the light of subsequent knowledge and experience. The manufacturers have therefore proposed to the Government that all products should be re-assessed from time to time as new scientific data accumulates.

All those directly concerned will be glad to learn that official approval of any product may be modified or even withdrawn as and when safer products become available.

Vietnamese Forests

NORTH VIETNAM, or, to give it its modern designation, the Democratic Republic of Vietnam, is densely forested and holds a unique position among the countries of the Communist 'camp' in that it lies entirely within the tropics. The only other Communist country possessing any tropical hardwood forests is China, but her forest resources are so small that she has little or no timber to export. Thus it is no surprise to learn that both the U.S.S.R. and China are sedulously helping North Vietnam to develop her forestry.

According to Le Diui Tring, Deputy Minister of Agriculture and Forestry for North Vietnam, Russian and Chinese capital and forestry experts have been made available and Vietnamese students are being trained at Moscow, Leningrad and Pekin. The need for trained staff is considerable, for the total forest area of North Vietnam is about 22 million acres and the total volume of standing timber is 1.5 million cu. m.

Advance Australia!

IT IS ALWAYS difficult for a mainly agricultural country to develop a balanced economy, particularly where the essential raw materials and trained manpower are seriously lacking.

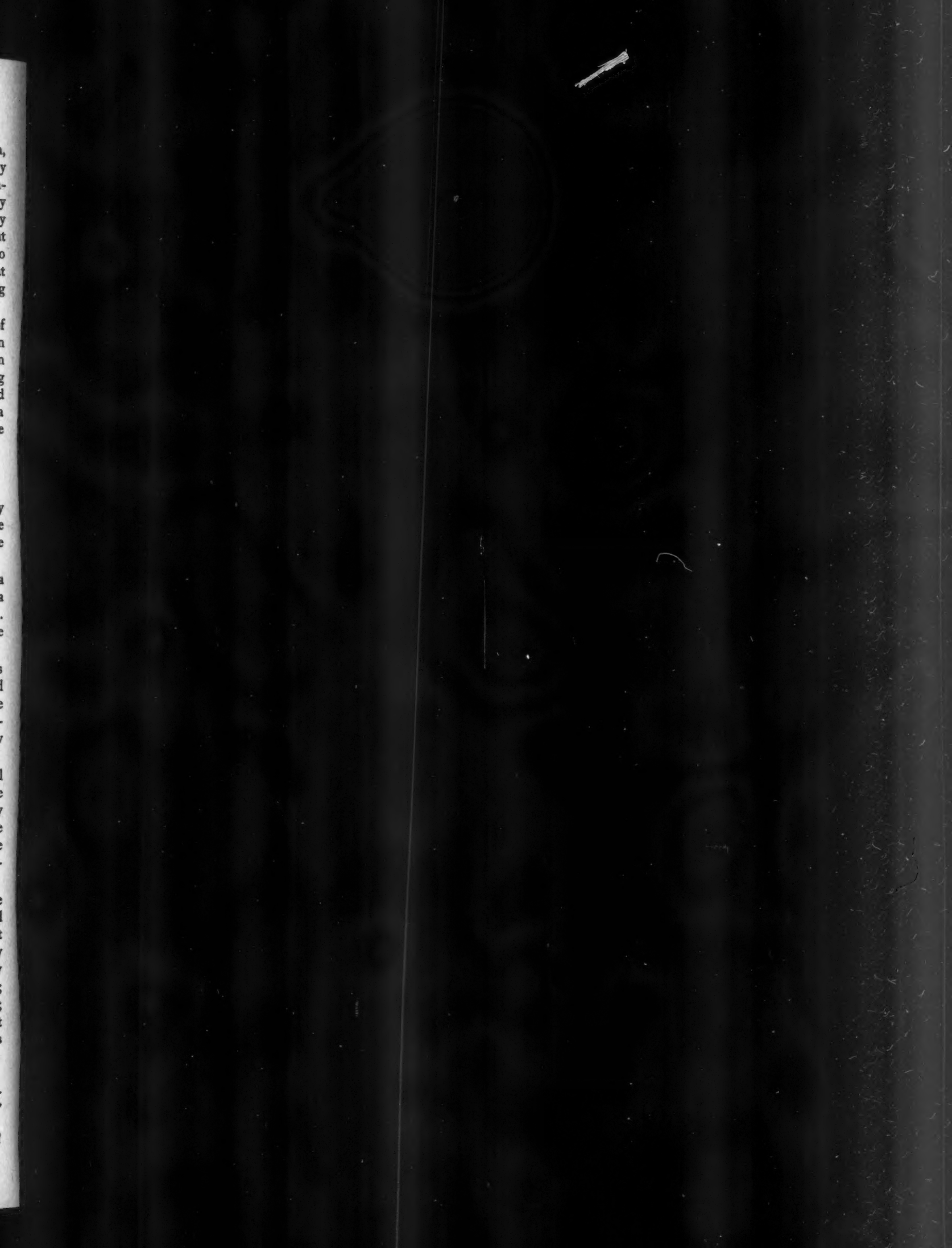
It is true, nevertheless, that while Western Australia has, in its brief history, been developed mainly as a rural state, the recent visit of a team of nine U.K. industrialists may well lead to a radical change in the economy and an upsurge in industrial development.

In their report,* they point out that, on account of its closeness to the ever-expanding markets of Asia and Africa, its very abundant mineral resources and the availability today of men with a high standard of technical education and apprenticeship, the state is now ripe for the establishment of new industries.

There would appear to be many fields for industrial development and in substantiation of their confidence and optimism it is stated that agreements have already been finalised, or are in course of negotiation, for the establishment of 10 major industrial projects to the value of £100 million by Australian and U.K. companies.

Investment possibilities with a direct bearing on the agricultural development of Australia, East Africa and S.E. Asian countries which are envisaged in the report include the manufacture of tractors, farm machinery and implements, farm trucks and cross-country vehicles; nitrogenous and phosphatic fertilisers; aluminium from local bauxite for irrigation equipment; and the production of agricultural chemicals, cement and concrete products for farm buildings, grain silos etc.

* *Opportunities for Industrial Development in Western Australia.* Published by Govt. of Western Australia, Savoy House, Strand, London, W.C.2, 1961.



A peep into the future, 'when every farmer will have his own aerial sprayer'. The new Napier 'Gyrocopter', which made its debut at Luton, England, in July

AIRCRAFT FOR AGRICULTURE—1

The Economics of Agricultural Aviation

R. J. COURSHEE, B.SC.*

Here the author analyses the time spent on various operations in aerial spraying and dusting and makes suggestions for the profitable operation of agricultural aircraft.

AIRCRAFT are widely used for agriculture in those countries where the need to cross vast roadless areas puts their value beyond doubt. Their use is spreading, however, from extensive agriculture and plantation-scale intensive agriculture into the agricultural systems which are more usual in Europe and Asia; that is, into small-scale intensive farming even where there are already adequate opportunities for ground machines to operate and many difficulties in using aircraft.

Air and ground spraying

A contract service employing aircraft for agricultural tasks is run for profit, so technical details need to be considered in their economic context. It is difficult in England to succeed commercially in agricultural aviation for a number of reasons.

N. D. Norman[1] has described how the cost per treated area is composed of fixed and running costs and how the latter depend primarily upon working speed and the amount of use the aircraft receives. In turn, these are affected by field size, by the distances between fields and between flying strips, by flying speed and other factors. He concluded that only a small reduction in operating costs was possible. Fixed costs could be spread more thinly over each acre treated if the amount of use of the aircraft could be increased from the usual 200-300 hours a year, but even this would result in only a small change in costs per acre.

The working cost is now about 20*s*. per acre, whereas ground machines are about half as costly to operate. In this simple comparison, however, we neglect other factors which affect the overall merits of the alternative methods. To the farmer the essential consideration is that aeroplane spraying or top-dressing costs an extra 10*s*. or so per acre.

Operating costs

The approximate annual cost for a typical business, as given by Norman, is shown in Table 1.

Table 1

Aircraft, annual fixed costs	£1,700
Aircraft, hourly running cost	£4
Pilot, annual cost ..	£1,850
Ground support cost (excluding markers)	£1,600
Markers to guide the pilot (employed intermittently) ..	£2.5 per hour
Overheads and administration ..	£1,100

* National Institute of Agricultural Engineering, Silsoe, England

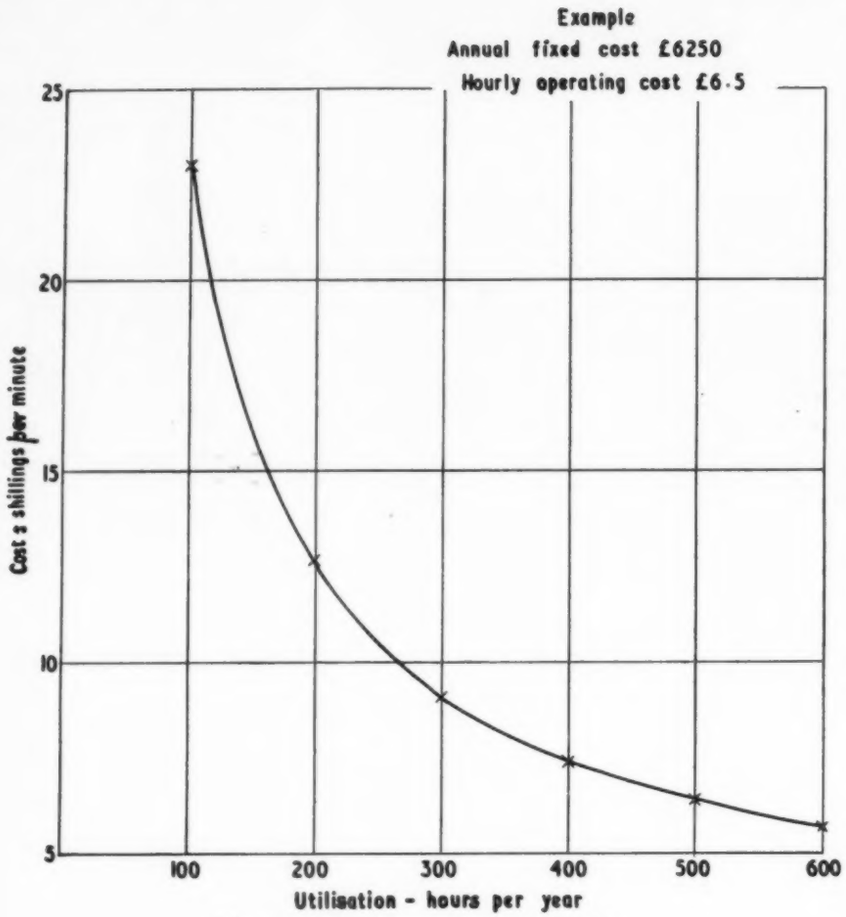


Fig. 1. Aircraft operating cost/utilisation

The total costs can be plotted against productive flying hours as in Fig. 1. This cost is a minimum with no provision for marketing costs and no allowance for profit. If it can be assumed that the annual costs cannot be altered, the only reduction in operating cost possible is through the greater utilisation of the aircraft.

Hours of operation

Hourly costs, and therefore cost per acre, would decrease if the utilisation could rise and, in turn, this would increase if cost per acre could shrink. In England daylight hours suitable for agricultural aviation operations seem to average two per day during the first three months of the season and three per day during the last three.[1] Therefore there are only about 400 hours a year available, if every opportunity is taken in the period March-August. In practice, Norman has found that about half of the available time is used.

The potential rise in utilisation from 200 hours a year to the 400 hours maximum would result in a decrease in hourly cost from, say, £36 to £24 an hour. This would be a considerable reduction, but the strain on the pilot and ground staff of seizing every moment fit for flying might be too great to effect this 33% reduction in hourly costs.

For utilisation to rise appreciably without this strain the season must be extended outside the period March-August. If winter work is not available in northern countries, the contractors would have to move south to work on winter crops, as many now do on cotton.

Supplementary operations

One way of increasing utilisation in Britain to a figure near to the pilot's legal limit of 120 hours a month would be to apply granular pesticides and fertiliser during the slightly windy periods considered unsuitable for crop spraying. These granular materials, applied from a height of 15 ft. and falling at a speed of 20 ft. per sec., are almost unaffected by a light wind. For example, at a wind speed of 10 ft. per sec., gusts would range mainly from 7-13 ft. per sec. with a duration of a few seconds. A swath of granular material would then be deflected only 3 ft. either way.

This error may sound serious but with distribution equipment which gives a 20-ft. working swath it might be unimportant, as indicated by the results of indoor trials (Fig. 2). Before these results can be accepted it is still necessary to determine whether it is safe for the pilot to fly in a breeze at a height of only 15 ft. in the prevailing conditions.

If it is not possible to work in warmer countries in the winter, fertiliser applications do offer some alternative work providing (1) the cost is no greater than it is for ground machines and (2) the work is done as well as the ground machines can do it.

One other possibility of increasing utilisation of the aircraft is to do more work in the period March-May by putting on granular weedkillers or sprays of weedkillers free from drift.

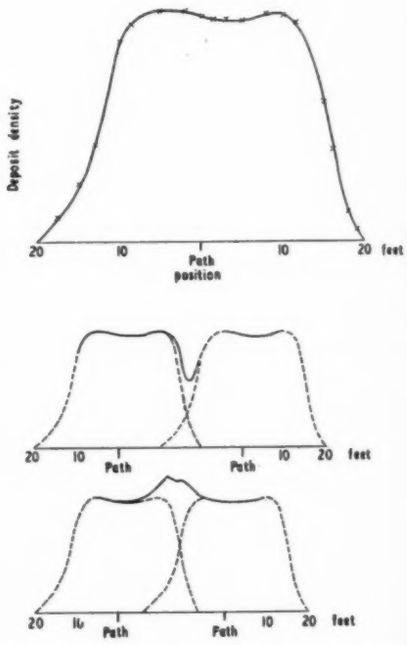
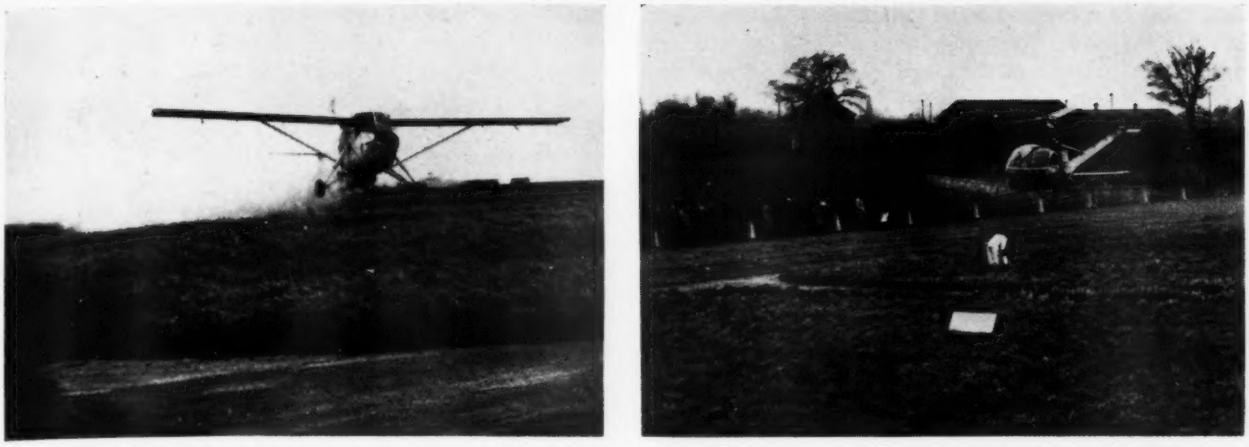


Fig. 2. Distribution of granular materials. - - - - single swath, —— overlap deposit

The average work done by one pilot during this period in two years was 24 hours a month, compared with 60 flyable and 120 permitted pilot hours.[1] So the absence of sufficient work may have limited utilisation in this period when, with safeguards, weedkillers could have been applied.

It seems, however, that the present limited use made of agricultural aircraft need not remain an obstacle to



Left: *Low-level dusting with a fixed-wing monoplane, showing the sideways dispersion caused by the down draught and a light side wind.* Right: *Spraying by helicopter, showing the projection of the spray about 1 ft. beyond the nozzles*

profitable contracting providing such ideas can be worked into commercial practice. Several concerns are progressing with investigations along these lines, so we can expect with some confidence that utilisation will soon approach the 400 hours a year potential.

The fixed annual costs account for three-quarters of the total cost when 400 hours of flying is done. If this balance between capital and other costs is preserved, there is only a small improvement to be had by increasing annual utilisation beyond 400 hours. To decrease the cost per acre beyond this point it is necessary to *cover more acres in the 400 hours* which are available (Fig. 3).

Table 2

Example: Total cost in relation to hours flown

Hours flown	*Hourly cost*
200	£38
400	£22
600	£18

Acreage treated per hour

It is clear that since the cost which is charged per acre multiplied by the number of acres treated in an hour must exceed the hourly cost of the work, the amount of work which can be done in each flyable hour affects the economic viability of the business.

From Fig. 1 an idea may be obtained of cost per hour even though actual costs will differ with aeroplane type and other factors, whereas these figures are only an example for a small fixed-wing plane. This cost per hour is to be met by charges on the area which can be treated in that hour and this may be from 15-60 acres. It is here that considerable difficulty is found in countries with small widely-spaced fields. Latimer-Needham[1] gives average work rates for aeroplanes in England as 2-4 min. per acre, depending firstly upon field size and secondly upon the load deposited per acre.

Norman shows that, whereas a helicopter manages to spray 60 acres an hour on average fields, a fixed-wing aeroplane manages to treat only 40. When top-dressing at about 1 cwt. per acre, the work rate of the aeroplane falls to 20 acres an hour. Accordingly a fixed hourly cost has to be spread over between 15-60 acres an hour and this means a fourfold variation in cost per acre for the same hourly cost. This wide range offers more opportunities for improvements than does an increase in utilisation, providing this lies above 400 hours a year.

Time per acre

The following treatment of working rates is similar in principle to that developed by Prof. Baltin.[2] The total

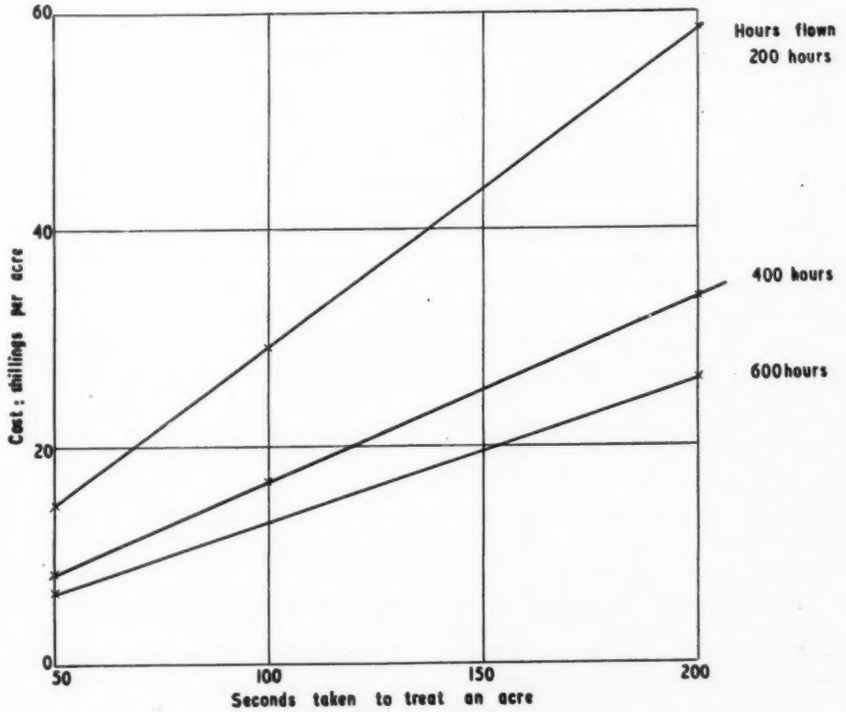


Fig. 3. Cost per acre and work rate in relation to the hours flown per year

time taken to spray an area of ground is made up of the following factors: time to load, land and take off, T_1; to fly to the field and back, T_2; to spray a swath, T_3; to turn, T_4; and time to travel to another field, T_5.

Each time is to be related to the amount of work done. Thus T_3 is the time taken to spray an area which has a length equal to the field length and width equal to the spray or fertiliser swath. T_1 and T_2 together form the reloading time which has to be spread over the number of acres $\frac{P}{D}$ covered with a payload P when a dose D per acre is being applied.

The time taken per acre then is:

$$T = \frac{T_1}{N} + \frac{T_2}{N} + \frac{T_3^{4840}}{SL} + \frac{T_4^{4840}}{SL} + \frac{T_5}{L^2}$$

where N is the number of acres treated in a payload and $\frac{4840}{SL}$ is the number of runs needed to spray an acre in a field of length L yd. and area L^2 sq. yd.

Some of the times are controlled by distance and flying speed. Thus $T_2 = \frac{2D_1}{V}$, where D_1 is the distance of the landing strip in yards from the work and V is the speed of the plane in yards per second. $T_5 = \frac{D_2}{V}$ where D_2 is the distance in yards between fields.

T_4 is also variable and from a little experimental data supplied by R. Amsden[3] it is assumed that $T_4 = V$. Thus at 20 yd. per sec. a helicopter takes 20 sec. to turn, whereas at 40 yd. per sec. an aeroplane takes 40 sec. to turn. This is also in accord with theory, providing the aircraft is making a flat turn restricted by centrifugal acceleration, although the actual figures will vary with the pilot and the aircraft.

Clearly from this multiplicity of factors a range of overall times is possible, but it is not necessary to explore the effect of all the factors.

Applying the formula

The first point to check is whether the total time taken per acre is about right. For this purpose typical figures can be selected arbitrarily:

N = 20 acres per payload for spraying.

T_1 = 300 sec. to load, land and take off.

T_2 = the time to go to load and return is 50 sec. for a speed of 40 yd. per sec. and a landing strip 1,000 yd. away from the treated field.

T_3 = 7 sec. to traverse the field if the field length is 280 yd. (16 acres).

S = the spray swath is usually 20 yd.

T_4 = the time to turn once is 40 sec. for an aeroplane.

T_5 = the time in seconds to travel to the next field is 50 for fields 2,000 yd. apart.

These typical figures result in a total time taken to treat an acre of 63.2 sec. This time is an underestimate except under the most favourable conditions, as Norman quotes 90 sec. per acre as being a more usual average time. Nevertheless, the estimate is of the right order.

The second use for this time estimate is to extract from it the most important pieces of information which it contains. Firstly, as has been pointed out, the time spent in spraying is a small fraction, *e.g.* one-seventh, of the time spent operating. Since the example under-estimates the total time consumed, but does not under-estimate the spraying time, it may be concluded that only about 10% of operating time is spraying time.

A second point worth noting is that the figures divide conveniently into two groups—above and below 10 sec. for the operation on each acre. Two duties—turning and refilling—consume nearly 80% of the available time and turning consumes over two-thirds of this. The remaining times are nearly negligible.

So clearly, on the one hand, turns must be made infrequently, *i.e.* work a long field, and also it is necessary to turn quickly, *i.e.* fly slowly. In other words, the increase in time taken to traverse the field by flying slowly may be more than balanced by the decrease in turning time.

On the other hand, high payloads and quick reloading, landing and take off are necessary to cut down the 15 sec. per acre spent on this task. In part 2 these factors will be examined in more detail.

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3. Amsden, R. C. *Private communication.*

(To be continued)

World Census of Plant Life

The compilation of an international index of the entire plant life of the earth was announced at a recent world conference at the Botanical Institute of the University of Genoa.

Automatic compilation will provide one master index of 1.7 million plant names by group, family, genus and species, so overcoming the confusion caused by scientists attaching different names to the same plant. Already 50,000 cards have been prepared, completing the index at group level, and work is now proceeding on the next lower order, the genus.

Each card in the completed index will contain a wealth of botanical information, including the author who first identified it and the publication where it was first classified, so providing a valuable cross-reference of botanical detail.

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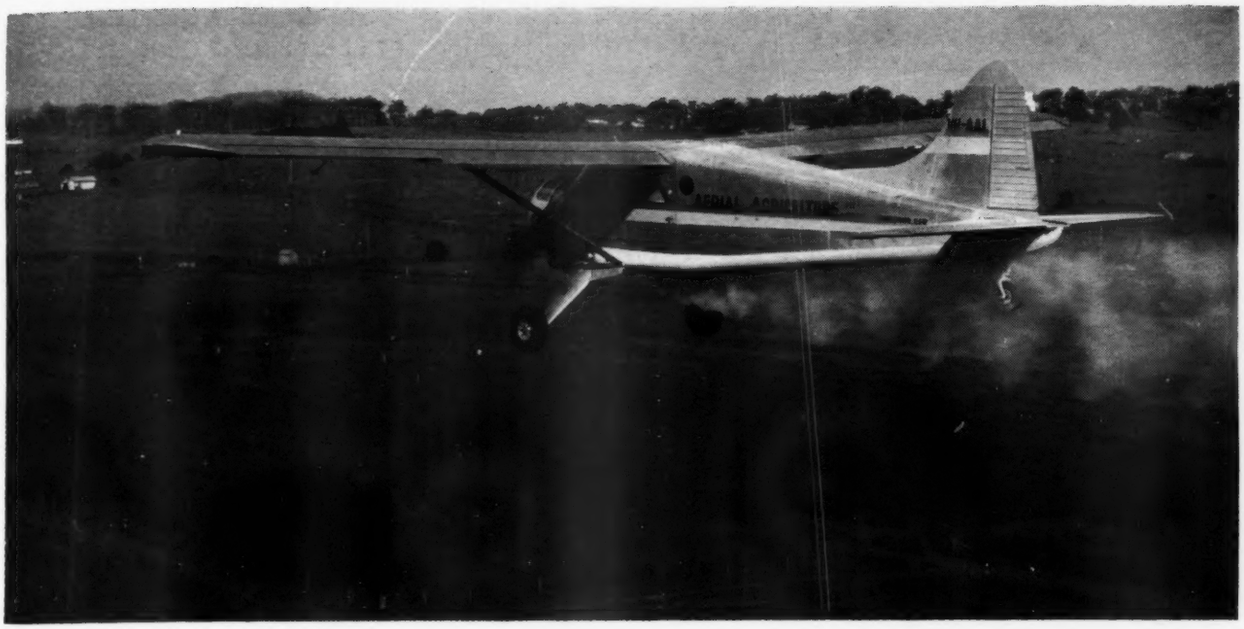


The Canadian Beaver aircraft seen in operation over a property in N.S.W.

Aerial Farming in Australia

L. T. SARDONE

Aeroplanes are being increasingly used in Australia for applying fertilisers, dusting and spraying agricultural chemicals and dropping fence posts and vermin baits in remote roadless and often inaccessible places.

AUSTRALIA, a primary producing country of great extent and immense potential, first considered the possibilities of aero-agriculture in 1929, *i.e.* over 30 years ago. The first recorded aerial application of a chemical was calcium arsenate, which was dusted from a R.A.A.F. Mk. 1 Gipsy Moth over a pine forest near Ballarat in the State of Victoria during that year in an attempt to control the lesser case moth. The kill was assessed at over 90%.

Spraying the linseed crop

Aero-agriculture, however, had its real beginnings in Australia in 1947, when caterpillar-infested linseed crops in the Narrabri district of northern New South Wales were dusted with DDT. The operator was Mr. Basil Brown, now operating *Air Farm Associates Pty. Ltd.*, of N.S.W., one of the few large organisations in the industry today.

In 1947, when linseed growing was being recommended as a source of high-protein feed, some way had to be found to spray the crop to combat insect attack. Tractor-drawn implements were regarded as more damaging than the pests, so aircraft was tried.

Spreading fertiliser

Following this success it was thought that the spreading of superphosphate from the air should be tried, especially as this was already being done in New Zealand.

Walcha, on the New England Tablelands, was the scene of the first trial. Tiger Moth aircraft, carrying a mere 2 cwt. per load, were then used. The results were outstanding, but concepts of payload capacity had to be revised. Progress over the intervening 12 years has not only been steady throughout Australia, but particularly in this State has assumed amazing proportions.

There are over 9 million acres of pasture improved country in N.S.W. and as so much of this area is hilly it is especially suited to aerial improvement.

New South Wales

Newer types of aircraft have since been introduced, carrying bigger payloads and putting out more superphosphate in an hour than was previously possible in a day. A technique of sowing lime-coated grass with the superphosphate has been perfected and the latest development is the mechanical handling of bulk fertiliser from factory to farm, hauling it loose in self-propelled loaders for bulk delivery into the waiting aircraft (see WORLD CROPS, 1958, **10**, 304).

A leading firm of contractors, *Aerial Agriculture Pty. Ltd.*, of N.S.W., have sprayed 100,000 tons of superphosphate over 2 million acres in N.S.W. during 1960, a feat claimed to be without parallel in any other country. This concern now employs 18 pilots and has 11 aircraft, each worth

Loading superphosphate from a mechanical feeder into a Tiger Moth

£A25,000*, and 12 loaders, valued at £A5,000 each.

Thirteen operators function in New South Wales, covering a variety of tasks, chiefly consisting of the laying of superphosphate, super with seed, insecticides and herbicides.

Victoria

In the smaller State of Victoria the position is changing. The largest company reports a decrease in the acreage treated with fertiliser, but an increase in the area sprayed with insecticides and herbicides. This company is covering an ever-increasing area yearly, using larger and more efficient aircraft. The Percival EP9, which they use now, is a high-wing monoplane built especially for aero-agricultural work. It will carry one ton of superphosphate or 190 gal. of insecticide and covers well over three times the area per hour as compared with the Tiger Moth. Its fuel consumption is only slightly greater than that of the Moth; it has twice the engine power and yet only requires a 200-yd. take-off when fully loaded.

South Australia

In South Australia a lot has been said in recent years concerning the high cost of aerial superphosphate spreading. Aerial spraying is given the benefit of the doubt when a valuable crop is threatened by pest or disease, or both.

On some of South Australia's large development projects the use of aircraft has paid, as they have provided a speedy means of fertilising and seeding large areas of flat land. This appreciation of the aircraft's usefulness, despite apparently high costs, is gratifying to operators who are themselves contending with their own very high cost structure.

Industry expansion, a need for increases in tonnage spread per hour and the growing obsolescence of the Tiger Moth have all put pressure on operators to re-equip with modern agricultural aircraft. A South Australian firm was first to do something about it by purchasing a Canadian-built Beaver aircraft. At over £A25,000 this is a big investment in an industry with a fair accident potential, plus high insurance premiums. This type of plane will meet most requirements. It lifts one ton of superphosphate, can spread up to 65 tons a day, has a reasonable minimum of operational controls and has been designed for hard use.

But conditions could be easier in this State for its several operators who are pioneering a still new and valuable aid to agriculture. Fuel tax is a burden and some overseas countries do subsidise new aircraft cost; help in either of these directions would encourage the industry's further development.

Scrub control in Queensland

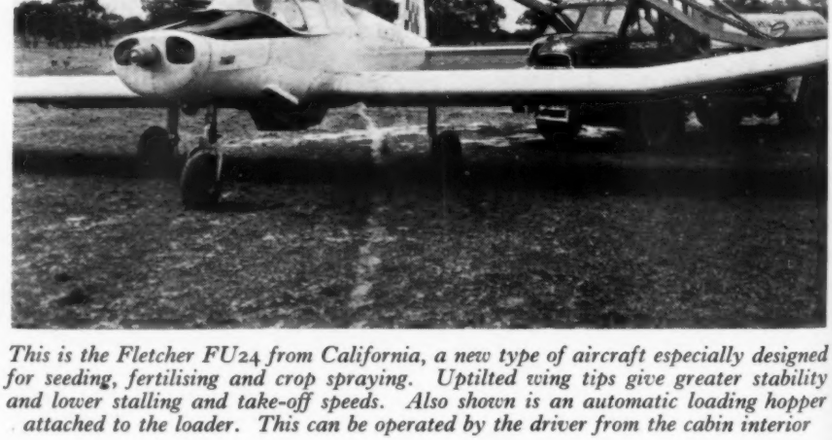
In the State of Queensland a good deal of Brigalow scrub was sprayed from the air with 2,4,5-T, but work was stopped because this hormone spray apparently failed to achieve a complete kill. In most cases the parent tree was killed, but the roots suckered again and the new growth was more vigorous. Other problems to be solved were the correct concentration of the hormone spray and time of spraying.

On virgin Brigalow scrub, however, spraying is still being carried out and is proving quite successful. However, further spraying appears to be bound up with economics. Long periods of dry weather, coupled with falling wool prices, have discouraged graziers from putting more money into costly land clearing.

Dropping poison baits

An unusual form of aero-agriculture in Queensland is the laying of dingo baits. Dingoes—the savage native wild dog killer—breed in the almost inaccessible hill country. Three years ago an agricultural aviation firm laid 48,000 baits made from phosphorus and meat-meal in the steep gorges of the Great Dividing Range. This involved quite tricky flying up and down the deep, narrow ravines.

The results appear to be very



This is the Fletcher FU24 from California, a new type of aircraft especially designed for seeding, fertilising and crop spraying. Uptilted wing tips give greater stability and lower stalling and take-off speeds. Also shown is an automatic loading hopper attached to the loader. This can be operated by the driver from the cabin interior

* £20 sterling = £A25.

encouraging. Although the dry season has been ideal for the detection of dingoes, as they are forced out of their breeding grounds, none have emerged from the area baited.

West Australia

In West Australia, another vast State, more than 200,000 acres were treated by aircraft during 1960. This was an increase of 75,000 acres over the previous year. Indications are that in 1961 the acreage covered will be greater than ever, as aerial contractors report well-filled order books.

Realising that, as the industry expands, planes giving increased efficiency must be provided, a West Australian firm recently took delivery of a low-wing monoplane—the Cropmaster KS3—the original Wackett trainer, extensively modified. Six of these are now in active operation in this State. The wing angle has been altered to give maximum manoeuvrability in the speed range in which agricultural aircraft normally function. A more powerful engine has been fitted with a constant-speed propeller to give maximum power under all flying conditions. Spray boom setting has been adapted, using air turbulence to give greater penetration. Pilot comfort has also been considered, with the use of an enclosed cockpit with good visibility. The provision of flaps and brakes ensures a rapid turn-round and fuel consumption, carrying twice the load, is only 1 gal. per hour more than the Tiger Moth. Except for the engine, the plane is entirely built in Australia, so that spares are readily available.

Generally, major aero-agricultural activity in Australia is centred in New South Wales, Victoria and Western Australia, with a total of 60 companies and single operators flying several hundred aircraft and employing some 250 pilots.

Insect plagues have been conquered, sowing techniques revolutionised and pastures improved by as much as 600%. Total acreage treated is rising by more than a million a year, while estimates for the year 1960 indicate that the acreage treated has exceeded 6 million.

Aircraft now in use include the Avro Cadet, Beaver, Ceres, Cessna 180, Cropmaster K53, Fletcher, Percival EP9, Piper Pawnee, Prospector and still, to a limited extent, the pioneer Tiger Moth. Bell, Bristol and Hiller helicopters are also used, but not very extensively as yet.

A Hiller helicopter engaged in pasture spraying on a property in the Cooma district of N.S.W.

Hazards of aero-agriculture

Although the pilots earn between £A3,500 and £A5,000 a year, they have to devote a maximum of 100 hours a month to a type of tight low-level flying fraught with considerable hazard.

Whereas aero-agriculture has made a fine contribution to Australia's rural economy, it has had a bad safety record which makes it an almost prohibitive insurance risk.

Current statistics reveal 10.5 major accidents for every 10,000 hours of aerial farming. In the period 1950-58 pilots were involved in 72 accidents, four of them fatal. In 1959 there were 15 crashes, but no deaths. Since September 1960 there have been 13 agricultural plane crashes, with three pilots dead.

The principal cause of crashes is flying too low and striking power lines or a wire fence, or having insufficient height to pull out of a stall.

Top-dressing with superphosphate, accounting for 80% of aerial agricultural work, is the least dangerous operation because the pilot rarely flies at less than 150 ft. When spraying insecticides and herbicides the pilot flies at between 10 and 20 ft., usually over small paddocks, which means much banking and tilting at the turns. This is also accompanied by the exhausting task of taking off and landing every three or four minutes—the time taken to disperse the usual load of one ton of fertiliser over 20 acres.

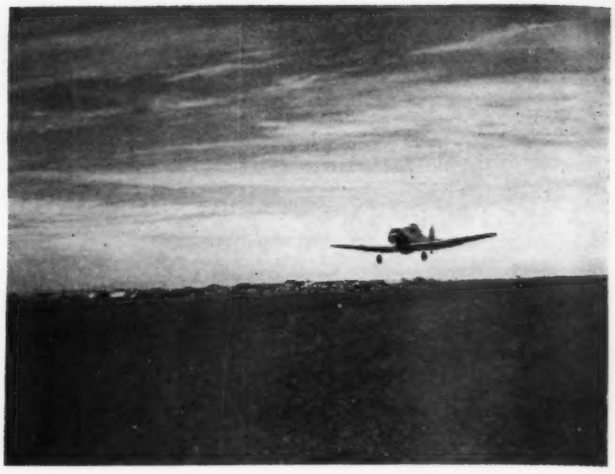
Safety regulations

Concerned at the high accident rate, the Australian Department of Civil Aviation has promulgated new safety regulations to prevent pilot fatigue and so improve operating efficiency.

The main provisions are that all aero-agricultural pilots must pass examinations covering every aspect of the industry. They will be licensed in two categories—Class I and Class II. Class I pilots have to possess a commercial pilot's licence and a minimum total of 500 hours' flying experience, 200 in actual agricultural operations.

Class II pilots will not take part in agricultural operations, except under the supervision of a Class I pilot. They must hold a commercial pilot's licence and have had at least 10 hours' specialised instruction in low-flying techniques. Their first 50 hours of operational flying must be under direct supervision and will include specialised training.

Other moves to improve safety standards include new requirements for firms engaged in aero-agriculture. These relate to aircraft maintenance,



Left: *The Fletcher FU24 can carry three-quarters of a ton of fertiliser.* Right: *The Ceres—a new type of agricultural aircraft built in Australia—taking off*

maintenance facilities and aircraft types and equipment.

The Department urges the pilots to wear crash helmets when flying. It will also strictly enforce regulations regarding the maintenance of airstrips. Some 3,000 properties in New South Wales alone are estimated to have strips for aero-agricultural work and keeping a proper check on these is a considerable undertaking.

Organisation and control

In an effort to impose a code of ethics and stabilise the industry, a national body was formed in 1959—the Aerial Agricultural Association—consisting of the principal aerial operators. Its aims are to unify the activities of contractors throughout the country, to promote the aero-agriculture industry, to achieve closer liaison between operators and the farmers, and to improve operating techniques generally.

A further big step towards securing greater efficiency in the industry, coupled with a higher safety margin, is the proposal by the Department of Civil Aviation and the Aerial Agriculture Association to establish a new flying school for the training of aero-agricultural pilots at the Hawkesbury Agricultural College in New South Wales.

By 1962 it is hoped to have a major part of these regulations operating. They will not only make a positive contribution towards improvement generally, but will greatly enhance a component of Australia's primary industry that is fast proving its worth.

Letter to the Editor

Eradication of Lallang or Illuk

Sir,—Your Editorial Comment in the June issue of WORLD CROPS draws attention to the impending ban in Malaya on the use of sodium arsenite as a weed and lallang killer. Your remark that a number of suitable substitutes for sodium arsenite were found at reasonable prices is presumably taken from the Government report made nearly a year ago on this subject. Regrettably, no substitutes for sodium arsenite have, as yet, been found that can compete either in terms of cost or efficiency.

The cheapest substitute appears to be sodium chlorate, the use of which, it is anticipated, will cost the rubber producing and related industries an extra annual expenditure of about $M8 million. As a matter of interest, the approximate loss of income tax revenue to the Malayan Government resulting from this extra expenditure by the industry will amount to some $M3 million per year.

The effectiveness of the triazines, to which reference is made in an article in the same issue of WORLD CROPS, is being actively investigated, but it should be realised that these compounds are unsuitable for the killing of weeds, their main attraction being the maintenance of weed control after the elimination of weeds in the first instance. The cost of using triazines has still to be determined through large-scale trials, but the evidence is that they cannot in any way compete price-wise with sodium arsenite.

J. K. MONEY.

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London, W.C.3.

Drought Warning in Nyasaland

The Secretary for Natural Resources in Nyasaland, Mr. R. W. Kettlewell, recently issued a warning that the Protectorate might suffer from drought in the next few years. Introducing a Bill to enable the Government to control food supplies, he told the Legislative Council that few things were more frightening than famine. In the 1949-50 season, the Government had imported 26,000 tons of food, costing £750,000, to avert a famine in the Southern Province. Mr. Kettlewell said it was absolutely essential that a central authority should control food resources, so as to reduce suffering and hunger, and damage to the economy of the country. The new measures would give the Government power to regulate and requisition food stocks and control their distribution.

Agricultural Aviation—1

The Development and Control of the Industry

Dr. W. J. MAAN*

Progress in the use of aircraft in agriculture has been hampered by irresponsible operators who offer to work at low rates but are unable to give effective service to the farmers who employ them.

IT was just 50 years ago that a German forest officer, Alfred Zimmermann, first put forward the idea of using aircraft in the war on pests and plagues. The Imperial Patent Office in Berlin even patented his invention, but he was not able to put his idea into practice.

Techniques in those days were not sufficiently developed and minds were not yet ready for the idea. This is understandable, since even scientists of vision and imagination regarded the future of aviation with considerable scepticism. In 1896 Lord Kelvin asserted, 'I have not the smallest molecule of faith in aerial navigation other than ballooning, or of expectation of good results from any of the trials we hear of'; and in 1902 Thomas A. Edison said, 'In the present state of science there are no known facts by which one could predict any commercial future for aerial navigation'.

Ten years after Zimmermann's patent, the Americans, C. R. Neillie and J. S. Houser, were the first† to prove the value of aerial application in their successful experiment against the larvae of the *Catalpa* sphinx at Troy in Ohio in August 1921. There followed many experiments all over the world, but before the second World War agricultural aviation generally was still of little significance and limited to a few hundred aeroplanes that were used for cotton dusting operations in the U.S.A.

U.S.A. Aerial dusting of cotton against the pink bollworm

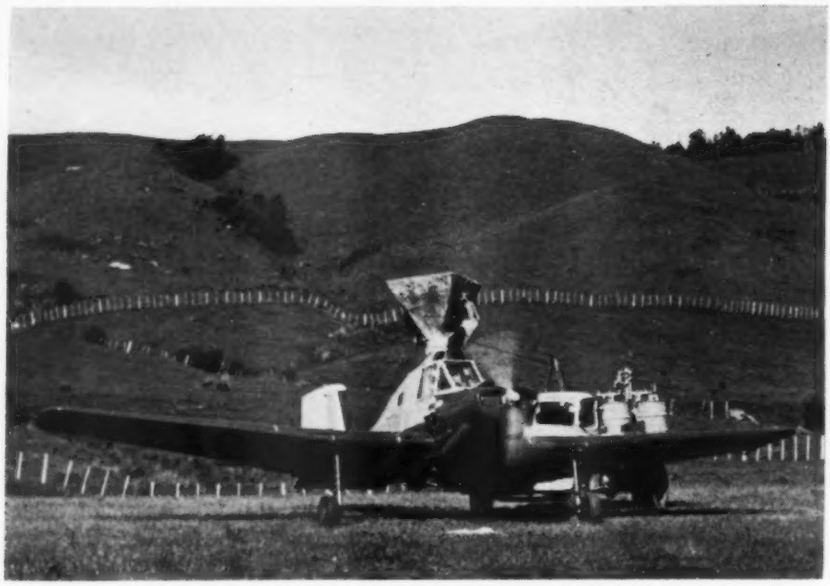
The rapid expansion after 1945 was due to several factors. Among these was the urgent need in industrialised countries to obtain great productivity per agricultural worker, the invention of DDT in 1941 and the introduction of a series of other agricultural chemicals later, all having the important essential of being effective at very low rates of application. This made possible the economic utilisation of the expensive payload capacity of the aeroplane, for one plane load of these new compounds could cover 7-10 times as much acreage as a similar load of the older pre-war chemicals. Rapid expansion has since followed.

Agricultural aviation today

For a few countries the number of aircraft engaged and the acreage treated is accurately known. Some countries, however, publish figures which are either extrapolations or mere estimates and, in any case, reliable statistics are usually only available some years later.

* Director, International Agricultural Aviation Centre, The Hague, Netherlands.

† There are reports of aerial applications having been made in 1917, 1918 and 1920, but these attempts were either unsuccessful or have remain unrecorded.



New Zealand. Loading fertiliser into an Auster 'Agricola' aircraft for top-dressing hill pastures

Table 1

Country	*Source*	*Year*	*Acreage treated (millions)*
U.S.A.	U.S. Dept. of Ag. '60	1957	61.3
U.S.S.R.	East Berlin Ag. Av. Con. '60 ..	1959	49.9
Canada	Can. Dept. Agr. '58	1957	6.8
New Zealand	Civ. Av. Adm. '59..	1958	4.5
Africa	I.A.A.C. comp. '61	1959	2.8
Australia	Dept. Civ. Av. '61..	1960	5.0
China	East Berlin Agr. Av. Con. '60 ..	1959	2.5
Latin America ..	I.A.A.C. comp. '60	1958	2.1
Europe..	(O.E.E.C. area) I.A.A.C. comp. '61	1959	1.4
Europe..	(Satellite area) I.A.A.C. est. '61 ..	1959	.4
Asia (except U.S.S.R. and China)	I.A.A.C. comp. '61	1958	.3

At the present time the world total of aerial operations is estimated to be 143 million acres of work annually, employing over 10,000 aeroplanes in agriculture and forestry. Two things are apparent from Table 1: first, that the U.S.A. (at present about 70 million acres) accounts for nearly half of the world total; and, secondly, that agricultural aviation in South and East Asia is still of little significance.

Nature of operations

Agricultural aviation operations in the world are very varied and are carried out both by aeroplanes and helicopters. Table 2 gives an analysis of the aerial farming operations carried out in the two leading countries—U.S.A. and U.S.S.R.—with the six types of work expressed as percentages.

Table 2

Agricultural Aviation Operations

Operation	*U.S.A.*	*U.S.S.R.*
Insect control ..	75	69
Plant disease control	77	
	2	
Weed and brush control ..	12	7
Fertilisation and liming ..	5	20
Crop defoliation	3·5	4
Crop seeding ..	2.5	—

Insect control is obviously the most important activity in the field of agricultural aviation and it must be borne in mind that in locust and grasshopper control, aircraft are being increasingly used.

It does not follow, however, that in every country insect control is the most important activity. In New Zealand, for instance, aerial fertilisation is the most important activity and there are other countries where the emphasis is on plant disease control,

Morocco. Refilling a 'Djinn' helicopter in locust control operations

such as Ecuador and the Cameroons (banana leaf spot or sigatoka), Japan (rice blast) and to a certain extent also Britain and the Netherlands (potato blight), Western Germany (leaf cast in pine) and France (mildew on vines).

Pattern of development

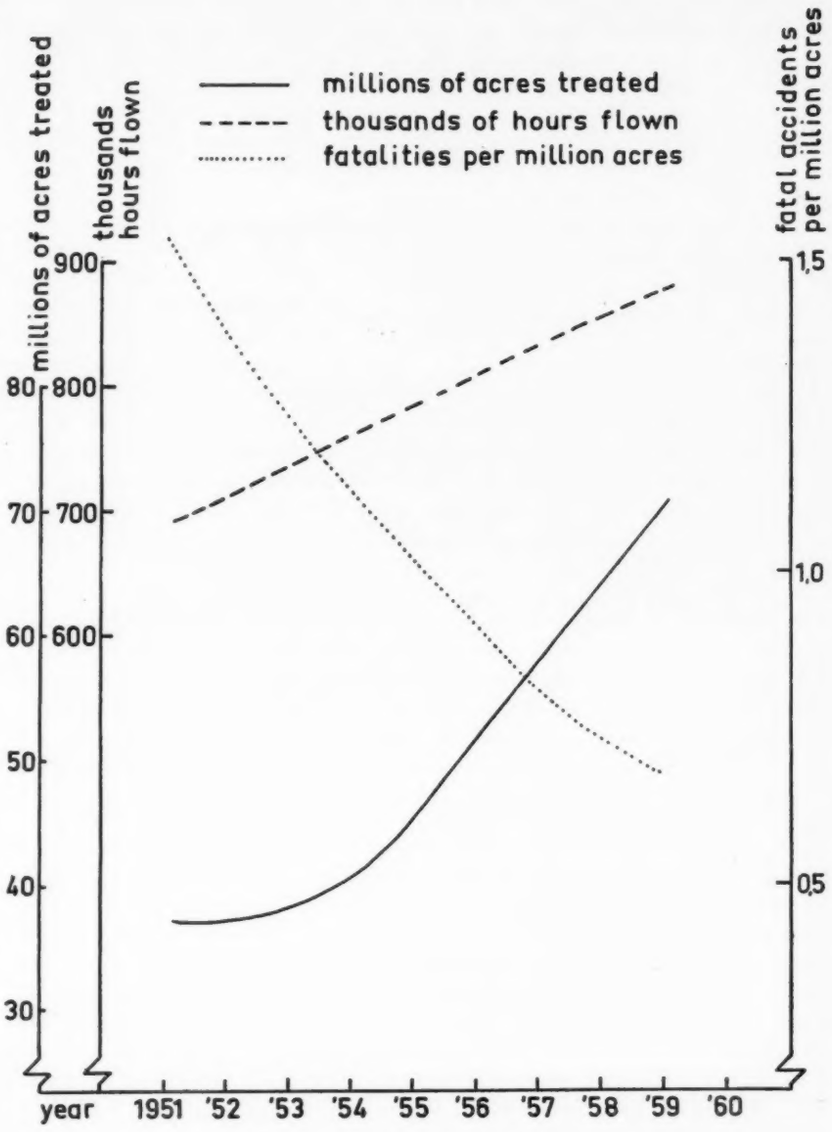
When there exists in a country sound possibilities for the development of agricultural aviation success will not follow automatically. On the contrary, there is every chance of failure. In nearly 15 years' experience the International Agricultural Aviation Centre has witnessed failures in several countries.

Failure usually takes the following course: After one or more successful experiments or demonstrations, the demand for the services of agricultural aviation grows. Inexperienced or irresponsible operators then start offering their services, usually at lower rates than those at which good work is technically possible. The customer, not being aware of this, thinks that competition among operators is in his favour, and this may sometimes be the case.

Netherlands. The 'Kolibrie' helicopter is suitable for spraying small fields

Destructive competition

Ultimately this under-bidding results in the disappearance or withdrawal of good operators. The newcomers, however, remain until they have, through inferior work or inadequate maintenance services, so spoilt the reputation of aerial application that in a few years the farmers lose all confidence in the aerial farming and revert to the use of ground machines. Subsequently it is extremely difficult, if not impossible, to restore this confidence.



Trends in agricultural aviation in the U.S.A.

Need for overall control

The sound development of agricultural aviation in any country requires the setting up of a competent authority to control and develop the industry along the right lines and, where necessary, give advice to the farmers.

The International Agricultural Aviation Centre in The Hague has assisted several countries in training their agricultural aviation experts and instructing them in the evaluation of aerial applications. The Centre is able to give the same service to other countries, acting as an independent international organisation.

The improvement in the standard of aerial operations is invariably accompanied by an increase in safety and by a decrease in the number of flying accidents. In the U.S.A. the accident rate in agricultural work has fallen to 4 (total) and 0.5 (fatal) per 10,000 flying hours. Chemical safety is also increasing; there are now hardly any reports of drift of toxic materials or destruction of fish or wild life. Damage through drift must and can be avoided. This problem, on which so many speak or write so much and so often, is in essence not so much a *drift* problem as a problem of operating standards.

(*To be continued*)

MAKING MAPS FOR AGRICULTURE

1—Topographic Mapping from Air Photographs

B. SLOANE, B.A.*

The production of topographic maps is fundamental to the assessment of the resources and to the planned economic development of a country. This is an account of the work that is being done by the Directorate of Overseas Surveys in the U.K., which is the department responsible for carrying out surveys and mapping British Dependent Territories overseas on which development programmes can be based.

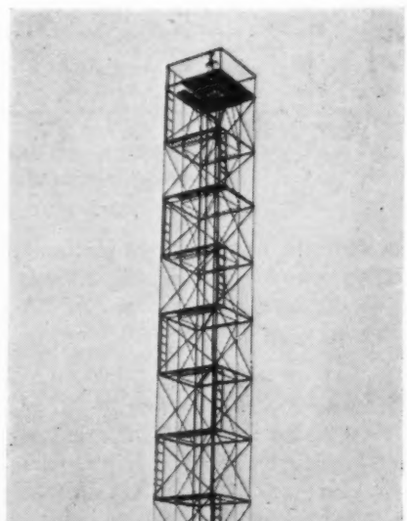
IN general, the countries showing disparity between their populations and their resources, *i.e.* the underdeveloped regions of the world, lie within the tropics, where the economy is primarily agricultural. Before any major advances can be made in developing these countries it is necessary to make an assessment of their potential resources and for this the map is the basic document. Using a map, a great deal can be discovered about the relationship between land and people, and also much of the basic information needed for drawing up development programmes.

For the administrator and the land-use planner, topographic maps provide an ideal substitute for first-hand knowledge of areas they cannot reach; for the engineer accurate contoured maps are absolutely essential; and for the agriculturist and field officer, maps provide an excellent base on which to record observations and formulate ideas.

A vicious circle

In general, countries which are not making the fullest use of their resources are, or were until recently, also under-mapped. Before the last war their small survey departments could only undertake the more pressing tasks, leaving much basic mapping undone. In consequence economic development was retarded and there was less money available to spend on surveys.

It was not until after the war that mapping could be carried out on an extensive scale. Techniques which had been developed for military purposes led to advances in aerial mapping, whilst the post-war impetus to economic development in the colonial territories underlined the need for up-to-date and reliable maps.



Survey control in flat country may require tower constructions of this kind

Photo: A. L. Allan

The 'Tellurometer', an instrument for the accurate measuring of distances between two and 35 miles by micro-wave radar, in use in Kenya

The department now responsible for surveys and map production from aerial photographs in British Dependent Territories is the Directorate of Overseas Surveys, which was set up in 1946 under the Colonial Development and Welfare Act. Its headquarters are at Tolworth, Surrey, England.

Map scales used

For most of the territories the medium scale of 1 : 50,000 has been found to be the best and much production of topographic maps is at this scale. Desert and semi-desert areas, *e.g.* Bechuanaland, are being mapped at smaller scales, and the more developed areas, *e.g.* West Indian islands, are produced at larger scales.

Large-scale cadastral maps which

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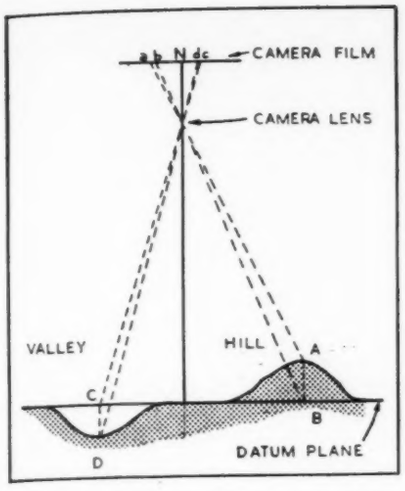


Fig. 1. Effect of altitude on aerial photography

show individual buildings and property boundaries in urban areas in great detail are also produced, *e.g.* for Nassau in the Bahamas at 1 : 2,500 and Freetown in Sierra Leone at 1 : 10,000.

Priority is given to areas where maps are urgently required in connection with new development projects, such as irrigation and hydro-electric power schemes, exploitation of mineral resources, and agriculture and forestry programmes. The economics of mapping programmes have of necessity been subordinated to the overall requirements of development programmes.

Air photographs

Air photographs are taken with cameras mounted in aircraft to point vertically downwards. Exposures are arranged so that each photograph overlaps the next by 60% to ensure that every object on the ground appears in at least two consecutive photos. Each strip of photography should also overlap the next strip by about 25%.

The photographs are a complete and nearly permanent record of the earth's surface at the time of photography. However, they cannot be regarded as maps in themselves, since they are not true to scale. The overall scale depends on the height of the aircraft above the ground: over level ground the scale would remain fairly constant, provided the aircraft was flying straight and level, but in mountainous country higher ground will appear on a larger scale than the low-lying areas. Thus the scale can vary widely over a single print.

This variation in scale of objects at different altitudes on a single photograph is accompanied by a displacement of the image of these objects. This image displacement is radially away from, or closer to, the centre or principal point of the photograph (see Fig. 1).

Because this displacement is radial from the centre the angular relationship between two object images on a photograph and the centre point is a correct one; it is the same as that between the objects on the ground and the position of the photographic centre point on the ground.

Further, because of the 60% overlap between successive photographs, pairs of air photos may be viewed stereoscopically. By viewing simultaneously one photo with one eye and the other photo with the other eye a three-dimensional image of the area of common ground is obtained. The two principles of stereoscopy and of true angular measurement from the centre point are of utmost importance to the map maker.

Aerial photography

The process of map production in the Directorate of Overseas Survey falls into three well-defined phases: making air photographs, obtaining ground control, and combining both in producing maps.

In the early days of the Directorate, aerial photography was done by the R.A.F., but since 1951 commercial companies, among whom the chief are *Hunting Surveys Ltd.* and *Fairey Air Surveys Ltd.*, have been employed on a contractual basis.

Photographic cover of about half a million sq. miles in the overseas territories has been achieved under contract during the last 10 years. This, together with aerial photography by the R.A.F. and that by overseas survey departments, totals about 1½ million sq. miles.

Today, improved lenses have made it possible to reduce the scale of photography from 1 : 30,000 to 1 : 40,000 and even smaller scales, so that fewer air photographs are required to cover a given area of ground with a consequent reduction in cost.

Successful completion of the air photography in tropical areas depends very much on local weather. Thus in British Guiana the air photo cover is still incomplete owing to the prevalence of cloud throughout the year.† Elsewhere photography has to be timed to coincide with the dry season, though in the savanna grasslands of many parts of Africa bush fires are a serious dry-season hazard.

† Interruptions or breaks in the succession of photography caused by cloud or smoke will usually make a series of photographs unsuitable for map reproduction and the flight may have to be repeated. In the tropics aerial photography is best carried out in the early morning and in the evening.—Ed.

On reconnaissance survey in Africa

Photo: R. F. White

A Pakistani survey officer on a training course using 'Multiplex' equipment for drawing contours

Ground control

With air survey, less ground survey is required, but it is still of fundamental importance to obtain a small number of fixed points by triangulation and levelling, so that the air photography can be correctly related to the ground and the survey framework, *i.e.* the latitude and longitude and height above sea level of the area in question.

The Directorate has several teams of surveyors in the field. These are concerned with the accurate fixing of positions and heights of a number of points which can be identified on the air photographs. These control points make possible the adjustment of scale and orientation of the photography which is necessary before mapping can begin.

The field surveyors are also working on long-term geodetic surveys, which provide continent-wide frameworks of reference points, whose position and height have been determined with great accuracy. Future surveys will be linked to these points, thus avoiding the difficulty and expense which formerly arose through unco-ordinated local surveys.

Use of radar

A recent development in ground survey methods which is being put to use by Directorate surveyors is the tellurometer, a micro-wave radar distance-measuring instrument made in South Africa. This enables very accurate measurements to be taken over long distances and is independent of adverse weather and poor visibility. The saving in time effected by using this instrument is marked.

Work under difficult conditions has been greatly facilitated in the forests of North Borneo and Sarawak, the fogs of the Falkland Islands and the Harmattan haze of West Africa. In the West Indies the tellurometer has been used to provide control for large-scale mapping and cadastral surveys.

Making the maps

When the surveyors have completed their observations and have annotated selected individual prints with the control points they turn over their material and notebooks to the Directorate, where the survey records are computed and the air photos interpreted preparatory to drawing the maps.

Before detail can be transferred to the map from the air photograph it must first be correlated and orientated with the known ground points, and secondly the inaccuracies of the photograph due to variations in scale must be resolved.

This is achieved by means of radial line triangulation, which makes use of the property of angular measurements being true from the centre of the photo. The principle is similar to that of plane tabling. The correct distance along the line of flight between the centre points of two photos is established and then, using this as a base line, the positions of objects in the overlap can be obtained by intersecting rays from the two centre points.

For large blocks of photography this adjustment is frequently made, using the slotted template assembly, which is a mechanical extension of the radial line principle.

The correct orientation of each photograph having been achieved in this way, the topographic detail that is required on the map is initially marked on the air photograph. The annotated features are then transferred to the map compilation, using the same radial line principle just described either graphically or mechanically.

Plotting the contours

Contours can be drawn from the air photographs as well. Instruments for this purpose, such as the *Williamson* 'Multiplex', project a three-dimensional model of the ground on to a plotting board. The operator is provided with a light dot, the vertical position of which can be related to a height scale and also accurately adjusted; this light dot is attached to a tracing table. In order to draw a

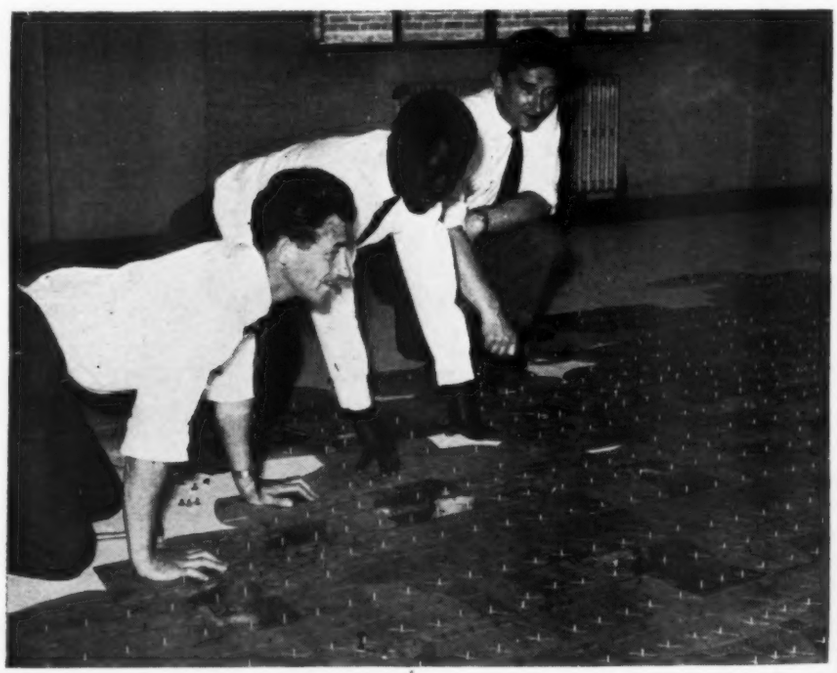


Photo: R. F. White

The slotted template assembly. The templates, one for each photograph, are laid down on a master grid drawn on a giant plotting board

Left: *The Hilser Watts radial line plotter, the introduction of which has speeded up the compilation of* 1 : 50,000 *maps*
Right: *Scribing lines rather than drawing them is another time-saving technique*

contour the operator places the light dot on the ground surface of the model and, keeping it on the ground, moves it round the model; the tracing table meanwhile plots the contour on the plotting board.

More complex stereoscopic plotting machines are used for large-scale mapping. One of British manufacture is the *Thompson-Watts* plotter. These machines have a system of floating marks in the focal planes of the eyepieces of the instrument and these can be made to float in space anywhere over the stereoscopic model and may be set down on the ground on any chosen feature whose outline may be traced and transferred to paper by means of a drawing arm and table. Large-scale plans of Barbados at 1 : 10,000 were produced in this way and a series at 1 : 2,500 is at present being undertaken for Nassau in the Bahamas.

Finalising the map

After the planimetric detail and the contours have been plotted, the plots are fair-drawn ready for reproduction. Much of this is done on conventional lines, but new techniques are being increasingly used. One recent development is that of scribing. Instead of lines describing roads, rivers and contours being drawn with Indian ink, they are cut with a sapphire stylus into an emulsion coat on a plastic base. This operation requires less training than the old-fashioned 'fair drawing' and the resulting saving in time for a given quality of work is considerable. Following fair drawing or scribing, printing plates are prepared in the usual way and the maps are published.

Some achievements

With over three-quarters of a million sq. miles mapped, it is obviously impossible to describe all the Directorate's mapping. However, some of the major projects which the Directorate has assisted should be noted. These include the initial planning of the Kariba and Volta hydro-electric power schemes, and more recently FAO's investigation of water control in central Tanganyika. This has involved mapping some 10,000 sq. miles of the Kilombero and Usangu Flats. Aerodrome construction in Fiji, phosphate production in Uganda and new road proposals in the West Indies are other projects which have been assisted.

In Africa most of the smaller territories, such as Gambia, Somaliland, Nyasaland, Basutoland and Swaziland, have been completely photographed; in others, such as Uganda and Sierra Leone, almost complete cover exists, whilst about two-thirds of Northern Rhodesia and Tanganyika have now been covered. Most of the islands in the Caribbean have also been photographed completely.

The Directorate's other work

The success of the Directorate's work so far has been due in no small way to the very close co-operation that has been established with the overseas governments. It has also been possible to maintain this co-operation following the passage of a country from dependent to independent status. When territories become independent they no longer qualify for new Colonial Development and Welfare funds, but they are, nevertheless, often anxious for the Directorate to continue giving assistance with survey work.

Various technical assistance schemes have been arranged in which the Directorate participates. In the case of Ghana the Directorate is co-operating with the Ghana Survey Department to map 54,000 sq. miles of the Northern Territory, as well as assisting with the training of Ghanaian personnel. A similar arrangement has been made for the Directorate to continue mapping the Northern Region of Nigeria.

Training of survey officers

A further aspect of the co-operation between the Directorate and overseas survey departments is the secondment of survey officers from overseas governments for periods of training at headquarters. There is no special training course as such, but a more flexible and informal arrangement in which different officers study different aspects of the work. The emphasis is on practical experience with individual supervision from senior members of the staff.

Some trainees come for periods of from 6-12 months for a general introduction to air survey methods; more senior officers specialise in particular aspects of the work, *e.g.* an officer from Pakistan recently spent nine months at the Directorate receiving instruction in the use of 'Multiplex' equipment. Currently a senior survey officer from Nigeria is studying the whole organisation to gain administrative knowledge of a large survey organisation.

Over the last 12 months the following countries have been represented

(*Continued on page* 355)

Aerial Crop Spraying

GUY GOODMAN

THE need for a suitable aircraft to fulfil all the requirements of crop spraying has been a problem for a number of years.

The initial use of fixed-wing aircraft did much to pioneer the way to the problem of aerial control of pests etc., but, as those actively engaged in the use of such aircraft know, the limitations and drawbacks are very obvious in fields of small acreage, of irregular configuration, and where obstruction such as overhead cables are present.

The use of the light helicopter as a spraying tool has virtually solved the problems of restricted areas and without a doubt provides the best coverage in spray application with its ability to get into odd corners and negotiate obstructions. The major drawback is in the initial cost of aircraft and the operating costs which inevitably affect the spraying cost per acre to the farmer.

The need to reduce the cost to the farmer is an obvious one and it is therefore very sound policy that *D. Napier & Sons Ltd.* and *Pan Britannica Industries* have combined their experience in an attempt to produce an aircraft with the agility of the helicopter, yet at a cost which will compare favourably with other types of agricultural machinery, such as a combine harvester, the object being to cut considerably the cost of aerial spraying per acre.

A 'Gyroplane', fitted with a spray boom, seen in operation. The propeller which gives the forward thrust is not visible due to rotation

This aircraft was demonstrated in the U.K. recently, but it is at present essentially a development tool and as such, until the project is completely evaluated, no figures are available on costing.

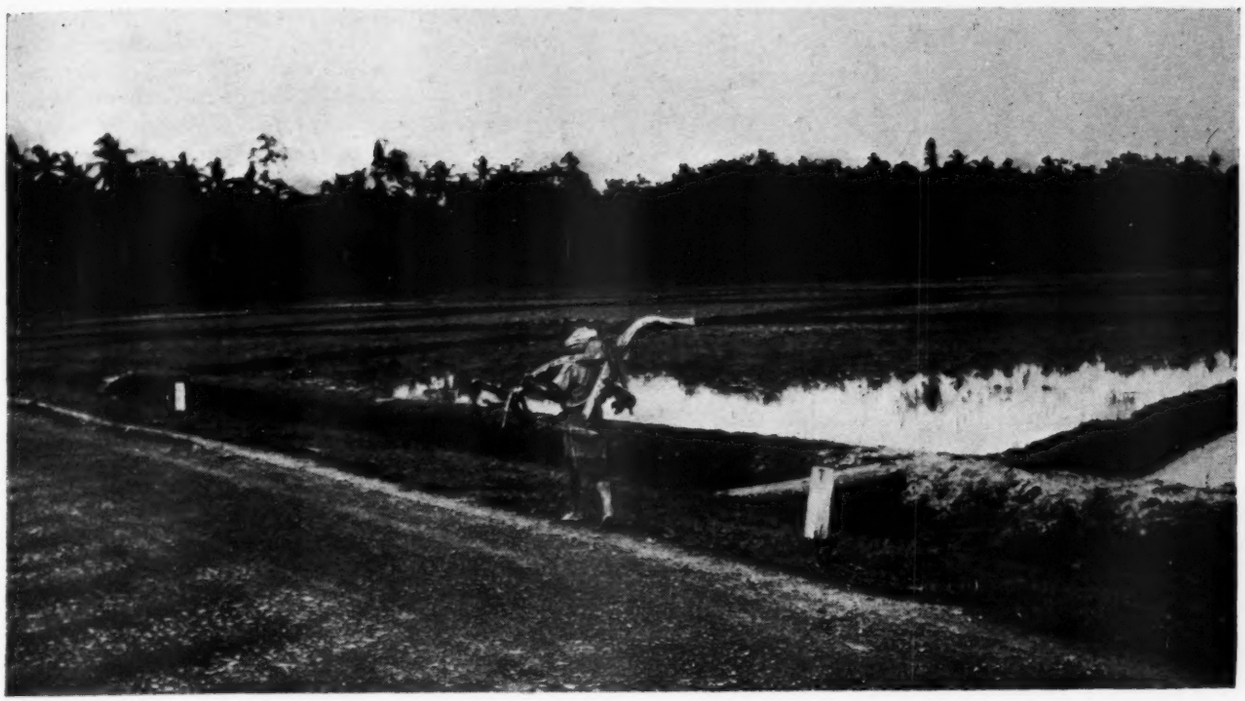
This 'Gyroplane' is primarily a farming tool, an aerial spraying device of simplest design; it is capable of being towed behind any farm vehicle, such as a Land Rover, and can be operated from restricted areas.

It should be pointed out, however, that this aircraft only has its potential in fields of small acreage—from 5-10 acres—due to its low payload per flight.

This machine will not provide the efficiency in spray application that is obtained from the use of the helicopter with its added ability to cope with acreages of all sizes and its capacity to carry a useful payload, as most aircraft spraying contractors will agree. Much time can be saved if bigger loads can be carried, inevitably resulting in less operating time and a reduction in cost to the farmer.

The intention of this report is to draw attention to the activities of D. Napier & Sons Ltd. and Pan Britannica in the field of agricultural aerial spraying and not to tangle with the complex problems of operating crop-spraying aircraft. The need is still apparent for aircraft manufacturers to produce a machine capable of hovering flight with excellent payload and at a cost that will result in a favourable comparison in spraying cost per acre to that obtained by ground machines.

The new aerial crop sprayer can be taken from job to job on a trailer towed by a Land Rover



Malaya. A large area of individually owned padi fields divided by low bunds which hold the water after the land has been flooded. Such an area could be consolidated and organised for mechanised farming using tractors

FROM MAN POWER TO MACHINES—2

Methods of Organising the Mechanisation of Small Farms

J. C. HAWKINS,* B.SC., N.D.A.

In Part 1, *the various forms of power available to the small farmer were considered. Now the author goes on to describe the best way in which to organise the mechanisation of peasant agriculture.*

Government hire services

MOST countries have at some time established an organisation equipped with tractors, drivers, implements and workshops to undertake work for smallholders at fixed charges. At the planning stage it is usually assumed that the service will lose money for a few years and will then begin to pay its way. In fact, this so rarely happens that it is safer to assume that no government hire service will ever pay its way in an area of very small and fragmented holdings and will probably lose a great deal of money.

The costs of running such a service are so high that smallholders cannot afford to pay the true cost per acre for the work that is done for them. These high costs are inherent in the system and are not, as is so often suggested, the result of muddle and inefficiency by a government organisation attempting to run a commercial enterprise.

The very nature of the operations makes for high costs per acre, for each field is so small and the distances between one job and the next so great that tractor equipment cannot be worked efficiently. A high proportion of the time is spent in the slow job of starting or finishing fields or in travelling from job to job. The organisation and close supervision required to ensure good work and repair and maintenance of the equipment impose high overheads and the collection of numerous small hire charges and frequent bad debts adds to them.

These disadvantages do not mean that there is not a good case for creating a government hire service in many countries; rather they are reasons for limiting its life. When it is decided to introduce mechanisation for the first time a hire service is

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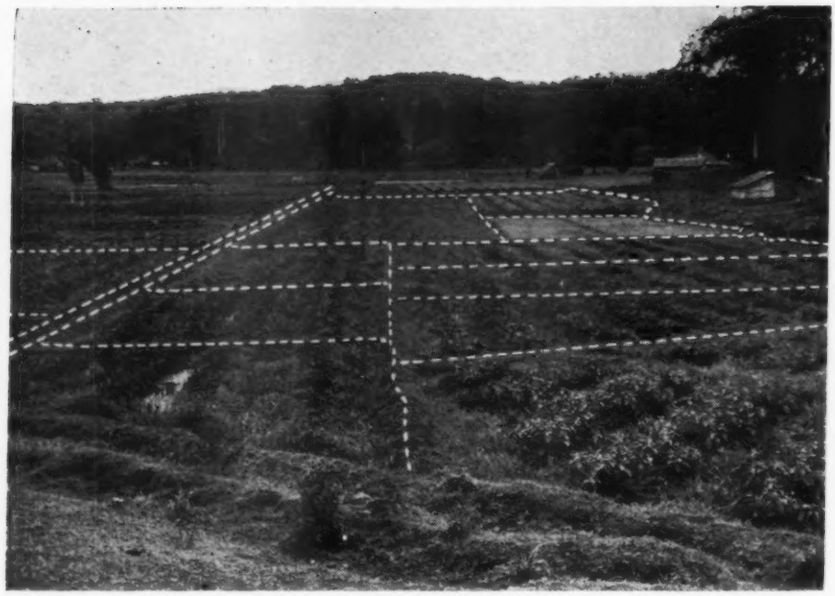


Malaya. Small irrigated plots of irregular shapes and sizes, individually operated and planted with different crops, are not suited to mechanised farming using tractors

probably the best way of starting. The small farmers see tractors at work and learn what they can do. A nucleus of competent tractor drivers and maintenance staff is built up in the country by the initial training schools that are needed. The research, advisory and administrative staff learn what mechanisation can do and what it costs, find the most suitable equipment and the right way of using it and generally gain the necessary experience to plan wisely for the future.

This combination of education, investigation and experience has to be paid for and it is not reasonable to expect small men who are struggling to make a living to pay very much towards it. Hire charges should, therefore, be based at first more on what the small farmer can afford than on the cost of the service he receives. Later they may be adjusted to a figure nearer the true cost of the work if it were done by an efficient commercial contracting system or by equipment on the holding. In all cases charges should be per acre so that the farmer knows how much he will have to pay before he asks for the work to be done.

At this point a political decision has to be taken as to whether it is desirable to continue the service as a subsidy to those making use of it or whether the time has come to close it down gradually and introduce one of the potentially more economical alternatives outlined below.

Co-operative ownership

One of the alternatives to a government hire service—the joint ownership* of a tractor and also its equipment by a group of small farmers—is frequently suggested and tried. This method of introducing mechanisation has the great advantage that a man can in effect own one-tenth of a tractor or less. The capital required from each individual in a group may well be no more, and could even be less, than would be required if each one bought, say, a team of oxen. Further, since it should be possible to use the tractor as efficiently as the layout of the district permits, costs per acre to the individual should be the minimum.

Co-operative ownership, however, presupposes that the small farmers concerned have a fairly comprehensive knowledge of what tractor equipment can do and how it should be used and maintained. This has rarely been the case in countries where it has been tried and is probably one of the main reasons why the system has failed. The close supervision and control required to teach such things have rarely been available and, if they have been, the individual members of the co-operative may have resented such interference in their affairs.

Co-operative ownership does not always lead to efficient tractor use even in highly developed countries, where everyone has a fair working knowledge of tractors and their equipment; it seems rather optimistic, therefore, to expect it to prosper in under-developed regions.

Apart from such technical handicaps, co-operative ownership very often suffers from one or more personal ones. Farmers, large and small, all over the world do not co-operate readily. The nature of their life makes them independently-minded individuals; they are used to doing operations on

* See WORLD CROPS, 1960, **12**, 93—Farm Machinery Syndicates.

Montserrat, West Indies. Boulder-strewn land which needs to be reclaimed before it can be settled by small farmers and cultivated mechanically

Left: *Malaya. Demonstration run with a small crawler tractor in an area of padi holdings which could be mechanically cultivated as a single unit.* Right: *Uganda. Tractor from the Government hire service cultivating land for a group of small farmers.*

their holdings when they want to, or when the weather lets them, and not when somebody else says that they can.

It is very hard to wait for your turn, when conditions are right in catchy weather, if you are a part-owner of the tractor and implements that you want to use. Again, when everybody owns equipment, nobody owns it and it is difficult to make sure that it receives the care and maintenance that the individual would give to his own property.

Quarrels over such matters have brought about the end of otherwise promising co-operative enterprises. In spite of these obstacles, there are probably a number of districts where the tribal or community spirit is strong enough to overcome them. Here one or two carefully chosen groups, which have received ample advice and guidance, plus financial help in the early stages, are making co-operative ownership work well at the present time.

Village contractors

Unlike co-operative ownership, the alternative of many small local contractors has been tried in relatively few countries. Where they have been established, however, or where individual contractors have arisen spontaneously, they have usually been very successful. It has, in fact, been through such a system that mechanisation first reached the smallest farmers in the more highly-developed countries. In every village or district a progressive and mechanically-minded man, or one of the larger farmers with a tractor, undertook work for his neighbours.

Mechanisation through small local contractors has a number of advantages over both a government hire service and co-operative ownership. The overheads are as low as they can be and, therefore, charges to the farmer can be as low as the local conditions permit. The contractor knows his customers and so difficulties over matters like orders of precedence, the area of fields, quality of work and bad debts can be settled by normal commercial practices. The small farmer is not called upon to find any capital at all and he can manage with far less knowledge and experience of mechanised agriculture than, say, the members of a co-operative. Finally, one man owns the equipment; it is probably his sole source of livelihood and so it has the best chance of receiving the necessary care and attention.

Village contractors will rarely arise spontaneously: it is most unlikely that the right man will have the enterprise and enough capital or credit, enough knowledge and experience or enough potential customers to make a start. It is here that a government organisation, especially if it has been running a hire service, can provide what is needed. From the knowledge gained during the years that the service has been operating it will be possible to decide first if an independent contractor can succeed.

The most suitable types of tractors and implements will be known, together with such things as the right type of cultivations for the district. The tractor drivers of the service may form the nucleus of the independent contractors and training facilities will almost certainly be in existence to train others. There will be equipment to start and experienced staff to supervise the new venture and local farmers will have learned what tractors can do. Those that have been using the service may form the village contractor's first customers, provided always that charges have, for some time, been fixed at a realistic level with the independent village contractor in mind.

Selection and training

In the establishment of village contractors there are four important stages: choosing the right men, providing them with sound training, making the right equipment available to them and seeing that help and advice are at hand when they are needed afterwards.

In most of these villages there is a man who is known as a general handyman or expert. He may be able to mend bicycles or do other simple repairs, to make cycle carriers or even guns, turn a paraffin can into a water vessel, or just to make shoes out of old motor tyres. He may be a blacksmith or an ex-Service man, or he may be driving a lorry or a bus. Provided his character is known to be good, he is the sort of man who might be chosen to be the contractor for his village.

He should first be given thorough training at a training centre on the tractor and equipment that will eventually become his own if and when he passes out successfully. These are then sold to him, at the end of his training, on generous hire-purchase terms,

making it absolutely clear that he will be able to keep the tractor and its equipment only if he maintains them in good condition and keeps up his payments. Both of these rules must be rigidly enforced and shown to be effective by taking away equipment at once, and as publicly as possible, from any early defaulters.

Back in his village, the new contractor can set up in business to meet the demands of the local small farmers. If he has a trailer, he can add to his income by carting supplies, water or road and building materials, but he must not be left to his own devices. He should be visited regularly, perhaps by his instructor from the training school, in order to see that he is doing good work, running on sound commercial lines, looking after his equipment and keeping up his payments. If he gives service and is efficient, he should make a good living; if he does not, he will go out of business and his equipment will pass to somebody else.

Land settlement

Land reclaimed for settlement by small farmers is probably the place where any experiments in the mechanisation of smallholdings should be started. It can be planned from the beginning for efficient mechanisation and so should be less of a problem than areas which have been settled for many years, and where any given holding may be made up of small pieces of land of irregular shapes and sizes and often a long way apart.

Even if the introduction of mechanisation is not contemplated at the time of settlement, any new land should always be laid out today with mechanisation in mind. It can still be worked efficiently by hand or with animals and, when mechanisation does come, it will not demand either the upheaval of a complete replanning to suit machinery or the acceptance of a less efficient form of mechanisation because the district was not laid out to suit tractors and their equipment in the first place.

In planning the layout of a new area the first consideration must be the design of an adequate soil conservation, drainage or irrigation system, whichever is needed. The next step is to site roads and villages and then to superimpose on this skeleton the patchwork of individual farms with fields that will permit tractor equipment to be worked efficiently. It may be wise to think of aircraft, too, so that aerial spraying or seeding can one day be used. If the holdings are small and the land has to be divided by contour banks, or irrigation and drainage channels, particularly careful planning is needed. The guiding principle must be to avoid any permanent form of boundary between one farm and another.

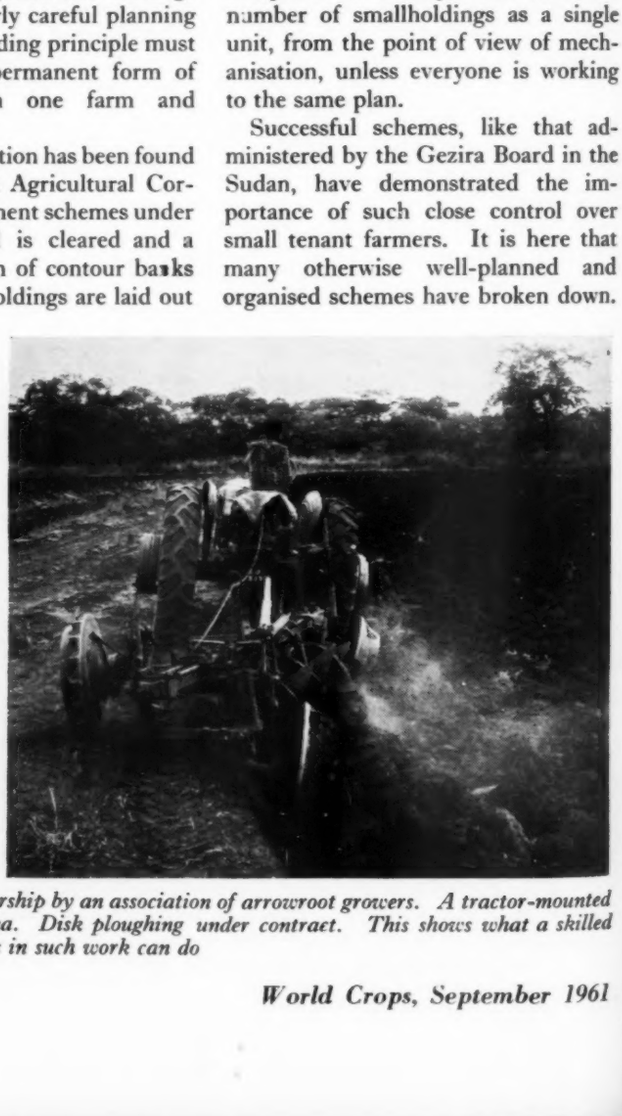
One possible solution has been found by the Tanganyika Agricultural Corporation. On settlement schemes under their control, land is cleared and a conventional system of contour banks is installed. The holdings are laid out across the contours with boundaries marked only with low permanent posts in the contour banks. The individual holdings are then farmed on a fixed rotation so that any contour strip carries the same crop in any given year. Each one can then be cultivated as a single field, the tractor and its equipment passing through one farm and into the next without obstruction.

While this plan may be ideal for some land, it cannot suit every district and must be modified to meet local conditions. Where the cropping is to be mainly paddy, for example, the divisions between holdings may have to be small bunds which can be removed and rebuilt mechanically when required.

Overall administration

When the proper layout and system of farming have been fixed, an organisation governing the farming of the district must be set up. In the early days, with farmers relatively unskilled in modern methods, it is essential that some form of rigid discipline be accepted. It is impossible to run a number of smallholdings as a single unit, from the point of view of mechanisation, unless everyone is working to the same plan.

Successful schemes, like that administered by the Gezira Board in the Sudan, have demonstrated the importance of such close control over small tenant farmers. It is here that many otherwise well-planned and organised schemes have broken down.



Left: *St. Vincent, West Indies. An example of co-operative ownership by an association of arrowroot growers. A tractor-mounted potato spinner is being used to lift the crop.* Right: *Tanganyika. Disk ploughing under contract. This shows what a skilled operator who specialises in such work can do*

Kenya. A properly planned settlement where full mechanisation is possible

Discipline and control, especially if they are imposed from outside, and in the absence of any tribal system, are very unpopular today.

Nevertheless, if some authority cannot ensure that all the individual farmers obey the same rules or are displaced if they do not, new areas will soon present just as difficult a mechanisation problem as those that have been settled for a long time.

Although rigid and enlightened control from above is essential in the early days of such settlement schemes, this need not be a permanent feature. As the individual farmers learn how to farm and use machinery efficiently and understand the importance of everybody working to the same plan, it may be possible to hand over the detailed control of the whole scheme gradually to a committee of the participants or to local tribal or village authorities. If this is done, it would probably be wise to retain some degree of overall control by the central government to make sure that the district continues to be farmed in such a way that economical mechanisation is possible, whether it be provided by a hire service, through co-operative ownership or by a system of village contractors.

Training for Plant Breeders

The first group of seven agricultural scientists from countries of the Near East has been sent to Mexico by FAO through a special grant from the Rockefeller Foundation. A sum of $150,000 has been provided for training plant breeders and FAO will be awarding 30 to 35 fellowships over the next five years. Groups of six or seven scientists are to be sent to Mexico and Colombia for eight or nine months for practical training in the field with nursery and laboratory work relating to all aspects of wheat improvement.

The first group, which left Rome on 14 February, consisted of: Mr. Huseyin Kutluk (Turkey), Mr. Ghulam Sakhi (Afghanistan), Mr. Hafeh Murabi (U.A.R., Syrian Region), Mr. Elham Hussein Talaat (U.A.R., Egyptian Region), Mr. Mansur Isa Baraighith (Libya), Mr. Hossein Kaveh (Iran) and Mr. Mansur Ahmad Bajun (Pakistan). They have all specialised in their own countries on the improvement of wheat. Now they will be trained under the supervision of Dr. Norman E. Borlaug, of the Rockefeller Foundation.

These fellowships are for young and promising agricultural scientists who have a B.Sc. degree in agricultural science or its equivalent and at least two years' experience in wheat improvement work and can speak and write English.

Making Maps for Agriculture

(*Continued from page* 349)

by personnel attached to D.O.S.: Nigeria, Pakistan, Ghana, Ceylon, Philippines, British Guiana, Burma, Somaliland, Gambia and Trinidad.

The main work of the Directorate—the production of topographic maps—is far from being spectacular, but it is, nevertheless, fundamental to the assessment of resources and planning the development of many overseas territories, which will go some way toward meeting the increasing needs of a growing world population.

Fertiliser Needs

India will require about $210 million of nitrogenous fertiliser to be imported during its present Third Five-Year Plan. In the first year the need is 410,000 tons of N, rising to 1 million tons by the fifth year. India will import about 1 million tons of ammonium sulphate in 1961-62 and produce domestically about 850,000 tons.

Our Next Issue

The October issue of WORLD CROPS will be a special number dealing with Tractors and Implements. Articles will include:—

Harvesting Rice by Combine by M. H. Breese, B.SC., D.I.C., F.R.E.S.

Climbing the Coconut by T. A. Davis.

Restoring Prosperity to the Centre of Western Civilisation.

The Pruning of Coffee by A. E. Haarer, F.L.S.

Agricultural Aviation—Part 2 by Dr. W. J. Maan.

Aircraft for Agriculture—Part 2 by R. J. Courshee, B.SC.

Making Maps for Agriculture—Part 2 *Agricultural Mapping from Air Photographs* by Martin Brunt.

World News

New Zealand

Tree Seed Improvement

As a contribution to the World Seed Campaign, the New Zealand Forest Service has made special efforts to improve the quality of tree seed. A seed certification scheme has been introduced which provides for the supply of seed certified for (*a*) species and origin; (*b*) germination and purity; (*c*) parent quality. Parent quality is regarded as a factor of paramount importance.

The procedure is to locate plantations, or groups, of exotic species which contain trees of above average phenotype with inspection by a seed committee of silvicultural and research officers to classify them, on various grades, as either 'seed stands' or 'seed sources'. Seed stands are areas set aside for seed production; seed sources are areas from which seed may be collected. The best mother trees are permanently marked. The selected areas are improved by heavy thinnings to remove inferior trees and to stimulate crown and seed production.

Dominican Republic

Rice Research Institute

An institute has been established to study rice and the economics of rice growing. The Government has invited a professor from Formosa and other Far East rice specialists to join the staff of the Rice Research Institute.

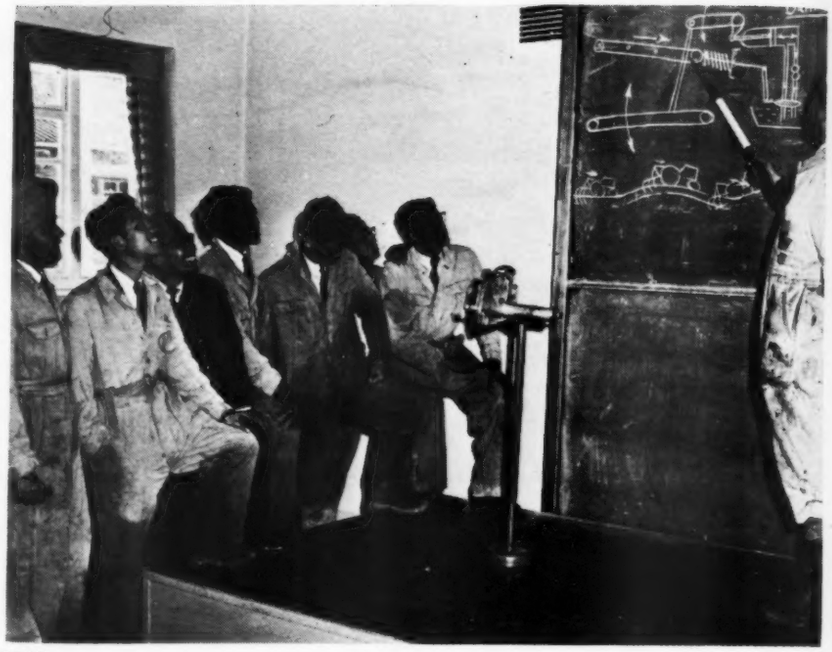
Ceylon

Coconut improvement

To improve the condition of the coconut estates and smallholdings in Ceylon, the Government launched a Coconut Rehabilitation Scheme in 1956. This scheme was divided into two parts: the first part aimed to step up the pace of replanting worn-out coconut lands by supplying high-grade seedlings at subsidised rates. This was operated by the Coconut Research Institute. The second part of the scheme aimed to improve the yields of existing estates and smallholdings by the supply of fertiliser to the owners at subsidised prices. This scheme is being managed by the Coconut Rehabilitation Department.

Under this Coconut Fertiliser Subsidy Scheme, one-third of the cost of fertiliser is met as a subsidy from the Government to the estates (*i.e.* over 20 acres) and one-half of the cost of fertiliser to all smallholdings with less than 20 acres.

During the year 1959 about 44,030 tons of subsidised fertiliser were distributed to estates and smallholdings covering 350,000 acres, which represents about one-third of total area under coconuts in Ceylon.



U.K.

A group of overseas student teachers under training in Britain listen to a lecture on the principles of the tractor hydraulic system during a short course on farm machinery at the Massey-Ferguson School of Farm Mechanisation

United Arab Republic

Increase of Agricultural Production

During the last 10 years the population of Egypt has increased by about 25%, but the area under cultivation has grown by only 10%. An examination of the individual crops clearly reveals that the efforts of the Government to improve cotton growing by better varieties, increased use of fertilisers and greater care in plant protection have brought about an increase in the yield of 15%. In the case of sugar-cane, the yield has increased by 25%, rice by 20% and onions by 10%.

Under the present Five-Year Plan (1960-65) it is intended to extend the arable lands by 914,270 acres to 6.9 million acres, so that the agricultural production will increase in value from £E135 million to £E171 million if all goes according to plan.

Eire

Spray Warning System

A system has been worked out by the Institute for Research in Dairying and Combulcht Siuicre Eireann Teo. that will warn the farmer when the aphids begin to migrate to the sugar-beet fields so that he knows when to spray. These warnings have to be acted upon quickly to prevent the spread of disease.

Field trials are being carried out and the different sprays and spraying times will be studied. Other studies planned will cover weed hosts, different strains of virus yellows and different species of aphids.

Coming Events

Pacific Science.—The Tenth Pacific Science Congress of the Pacific Science Association will be held at the University of Hawaii, Honolulu, from 21 August-6 September. The meeting is sponsored by the National Academy of Sciences, Washington, D.C., and Bernice P. Bishop Museum with the co-operation of the University of Hawaii. Enquiries to: Secretary, Tenth Pacific Science Congress, Bishop Museum, Honolulu 17, Hawaii, U.S.A.

Agricultural Science. — The next meeting of the British Association for the Advancement of Science will be held in Norwich, Norfolk, England, from 30 August-6 September.

Section M—Agriculture—will be presided over by Sir William Slater, secretary of the Agricultural Research Council. Enquiries to the Organising Secretary, 18 Adam Street, W.C.2.

Industrial Chemistry.—The 33rd International Congress of Industrial Chemistry will be held in Bordeaux from 1-8 October. One of the 23 sections will be devoted to agricultural science and the food industry. Information may be obtained from the Société de Chimie Industrielle, 28 rue Saint-Dominique, Paris VII, France.

Aerosols.—The third International Congress organised by the Federation of European Aerosol Associations will be held from 4-6 October in the Congress House, Lucerne, Switzerland. Further information, including programme and application forms, are available from the International Aerosol Association, Waisenhausstrasse 2, Zurich 1, Switzerland.

The first International Aerosol Exhibition will be held during the period of the Congress and for a further two days at the Kurst-und-Kongresshaus, Lucerne. Further information may be obtained from A. Wettler, c/o Pluss-Staufer A.G., Oftringen, Switzerland. The exhibition is open to the public and admission is free.

Forest Genetics and Tree Breeding.—To further the aims of the FAO World Seed Campaign, the Forestry Commission will hold a course on forest genetics, tree breeding and seed production at Northerwood House in the New Forest, Hampshire, from 9-13 October. Enquiries to: Chief Education Officer, Forestry Commission, 25 Savile Row, London, W.1.

Vines. — An International Vine Growing and Wine Fair will be held in Montpellier from 12-22 October. Further details may be obtained from Foire Internationale de la Vigne et du Vin, 11 bis rue de Loge, Montpellier, France.

Timber.—A Timber Fair will be held at Dusseldorf from 20-29 October. Details may be obtained from Nordwestdeutsche Ausstellungs-Gesselschaft m.b.H. (Nowea), Messegelande, Dusseldorf, W. Germany.

Agricultural Chemicals.—The 28th Annual Meeting of the National Agricultural Chemicals Association will be held from 29 October-1 November at The Homestead, Hot Springs, Virginia, U.S.A.

Water Treatment. — The second Effluent and Water Treatment Exhibition and Convention will be held in the Seymour Hall, London, from 31 October-3 November. Enquiries to the Exhibition Press Officer, 2 Broad Street Place, London, E.C.2.

Weeds.—The Annual Weed Conference is to be held by the Washington State Weed Association on 6-7 November. Further information from the Washington State Weed Association, Chinook Motel and Tower, Yakima, Washington, U.S.A.

Insecticides and Fungicides.—A conference on insecticides and fungicides will be held in Brighton from 7-10 November. The conference is sponsored by the Association of British Manufacturers of Agricultural Chemicals. Further details from A.B.M.A.C., 86 Strand, London, W.C.2.

Agricultural Exhibitions

Kenya.—The Royal Agricultural Show will be held in Nairobi from 27-30 September. Enquiries to the Royal Agricultural Society of Kenya, P.O. Box 30176, Nairobi.

Australia.—The Royal Agricultural Show is to be held in Perth from 29 September-10 October. Details from the Royal Agricultural Society, 239 Adelaide Terrace, Perth.

Canada.—The Royal Agricultural Winter Fair will be held at Toronto from 10-18 November. Enquiries to J. R. Johnston, Royal Coliseum, Exhibition Park, Toronto, 2B.

England.—The Royal Smithfield Show and Agricultural Exhibition will be held at Earls Court, London, from 4-8 December, 1961. Further details may be obtained from the Smithfield Show Joint Committee, S.M.N.T., Forbes House, Halkin Street, London, S.W.1.

Holland.—A Farm Machinery Exhibition will be held in Amsterdam from 22-27 January, 1962. Particulars from R.A.I. Gebouw N.W. Europaplein 8, Amsterdam, Netherlands.

Belgium.—An International Agricultural Machinery and Equipment Exhibition is to be held in Brussels from 11-18 February, 1962. Enquiries to Société de Mecanique et d'Industrie Agricoles, 29 rue de Spa, Bruxelles 4.

Libya.—An International Industrial, Commercial and Agricultural Fair is to be held in Tripoli from 20 February-20 March, 1962. Further details may be obtained from Dr. Ali Jazairy, Tripoli International Fair, Giaddat O. Muktar Tripoli, P.O. Box 891, Tripoli.

NOTE FOR CONTRIBUTORS AND AUTHORS

The editor welcomes authoritative articles and news items on agricultural machinery and agricultural methods, agricultural crops and new developments.

A short synopsis should preferably be included to assist the editor and the manuscript itself should be typed in double spacing with plenty of margin and on one side of paper only.

It should bear the name and address of the author and be accompanied by sharp photographs or line drawings with suitable captions.

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New Publications

Agricultural Aviation

First International Agricultural Aviation Conference. Published by International Agricultural Aviation Centre, The Hague, Netherlands. Pp. 429. Price 50*s*.

The Report on the First International Agricultural Aviation Conference with a foreword by H.R.H. The Duke of Edinburgh, is an impressive compilation of papers on the biological, technical, economic, operational, engineering and logistic aspects of agricultural aviation.

The book thus forms a mine of reference and an up-to-date review of the current technique and outstanding problems. It is regrettable that the review of the developments in agricultural aviation was compiled by an eminent figure in British public aviation whose knowledge of its agricultural application is, however, secondhand, incomplete and often out of focus.

Some of the papers contained in this book, notably those by Courshee, Hill, Lucassen, Norman and Yeo, will for a long time be referred to. I find it difficult not to notice while reading the Report on the First International Agricultural Aviation Conference how many important contributions to the theory and practice of agricultural aviation in Europe have been made from the U.K.

The book is well organised, attractively produced and a great credit to the International Agricultural Aviation Centre. It is indispensable to anyone concerned with this subject such as the manufacturer, operator, research worker and adviser.

W. E. RIPPER

Soil Conditions and Plant Growth

By E. W. Russell. Ninth edition. Pp. xvi + 688. Longmans, Green & Co. Ltd., 1961. Price 63*s*.

This book, which in its earlier editions has gained a world-wide reputation, is almost universally regarded as the standard textbook on the subjects comprised in its title. The first seven editions (1912-1937) were written by the author's father, Sir E. John Russell, and the eighth edition (1950) was published under the joint authorship of father and son.

The reasons which have earned this book its huge reputation are obvious. It is one of very few textbooks on soils that strikes the happy mean between the dreariness of the specialist's or undergraduate's textbook and the uninformative lightness of the popular book. Almost every page is not only reliably informative, but understandable to specialists in every branch, biological, chemical and physical, of the vast range of subjects covered.

The author cites thousands of references to the literature and, unlike most textbook writers, he ranges over the whole world of scientific literature and does not confine himself to literature written in his mother tongue. It is noticeable, however, that in the revised chapters of this edition the new references (1950 and later) are almost entirely to American and British work, but this is understandable, since the author had to undertake the task of revision while directing the East African Agricultural and Forestry Research Organisation in Kenya.

The book is essentially one of applied soil science and plant physiology, and frequent reference is made to the application of these sciences to agricultural and forestry practice. Revision has of necessity been confined to 13 chapters only, the other 24 being reprinted almost unchanged, sometimes giving the reader a feeling of out-of-dateness by comparison with the thoroughly revised chapters. These include the sections on soil chemistry and biology, two branches of soil science that have made great advances in recent years, and on the phosphorus nutrition of plants in relation to soil phosphorus.

The growing recognition that soil science is primarily a biological science is reflected in the amount of new material introduced into the chapters on soil biology and organic matter. It is regrettable, though inevitable, that virtually no reference is made to the vast amount of work done on these subjects during the last decade in Russia, Germany and Japan, but in the still speculative state of the knowledge gained, this is, perhaps, not a serious omission. The chapters on the soil fauna, now recognised as a major soil-forming factor, and on the general ecology of soil organisms have been considerably enlarged.

The last part of the book, dealing with a few selected aspects of soil management, is rather scrappy—for example, the chapter entitled 'The General Principles of Soil Management' is merely a short account of the control of soil erosion before the war. It is difficult to see the reasons for choosing the particular subjects discussed in these chapters. The first part of the book might well be extended at the expense of the last part.

G. V. JACKS

The Eucalypts

By A. R. Penford and J. L. Willis. Pp. 550. Illus. WORLD CROPS Series. Leonard Hill Ltd., London, 1961. Price 80*s*.

This is a splendid book. Every patriotic Australian should be a purchaser, and there must be also a great number of eucalyptus admirers outside its native habitat. The fact that this has appeared in the WORLD CROPS Series is an indication of how very widespread is the cult of the cultivation of the eucalypts.

In 550 pages the book attempts to deal with the botany, cultivation, distribution as an exotic, its pests and parasites, the uses and values of its timbers and of the tree for shelter, ornament, oil production and honey farming, paper-making, fibre-board, fodder and fuel. A herculean task, and something is bound to suffer in this process of condensation.

In dealing with the stem, the leaf, the fruit and seed, the authors, who are both chemists turned botanists, give an adequate survey of the plant structure, the bark types and flower structure which govern the present system for naming the species. Hybridisation also receives a fair survey, though one is left vaguely in doubt as to what tests to use in separating a hybrid from a polymorph, which is a single species with its own wide range of characters.

The statement on nomenclature is

supported with clear illustrations of the anther shapes which have been the basis for the currently accepted Blakeley classifications into six sections and about 700 species and varieties. The range in shape of the operculum of the unopened flower and of the mature seed capsule are also well illustrated.

A survey of timber values and characteristics is based inevitably upon Australian research experience, but need not necessarily agree with local experience elsewhere; for instance, of *Eucalyptus globulus*, as grown along the Mediterranean or in California, or of *E. camaldulensis* in Iraq and Ceylon, or of *E. rudis* and *tereticornis* under irrigation in the Punjab. In all these instances, so far as the reviewer knows, the quality of timber of these particular species is quite definitely poorer than the same home-grown in Australia or Tasmania, and even as fuel wood some of them are ranked very low.

The book admits great variations within Australia, quoting *E. maculata* as averaging 54 lb. per cu. ft. at 12% moisture from New South Wales, but 68 lb. from Queensland. It also notes many anomalies in the range of moisture content in the tree; for instance, the higher up in the tree, the greater the water content.

Turning to the chapter on the eucalypts as exotics, one is struck afresh with the astonishing versatility of the gums which are now an integral part of the landscape in a great many countries. The creation of Addis Ababa as a capital city with a population of half a million has been attributed to *E. globulus*, without which the nomads would never have settled; outside the capital also some 15 million peasants have adopted it as a farm crop for poles and fuel.

The book gives an account of the success attending the pioneering with eucalyptus planting initiated by Navarro de Andrade in reconstituting since 1910 the partially destroyed forests of Brazil, but makes no mention anywhere of *E. paulistana*, a reported hybrid of *globulus* x *robusta*, neither of which parents has been at all successful in the large-scale introductions of gums on the Paulista properties in Sao Paulo.

In a world survey of this scope it is easy to fault the authors, who obviously cannot gain all their information at first hand, but one would expect to find them making more use of fairly recent bibliographic references.

This criticism is not intended to detract from the value of the book. A reviewer naturally searches for the items which he hopes will have been used. If they have not, that is unfortunate, but the value of a book does not depend upon the completeness of its bibliographic list. Its real value lies in the painstaking survey of those eucalypts, whose diversity both within their native Australia and abroad has opened up a new field of endeavour as fast - growing replacements of the world's diminishing forests.

R. MACLAGAN GORRIE

To All Readers

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Rubber

Proceedings of the Natural Rubber Conference, Kuala Lumpur, 1960. Pp. 896 + xix. Published by the Rubber Research Institute of Malaya, P.O. Box 150, Kuala Lumpur, Federation of Malaya, 1961. Price not stated.

This volume contains the papers presented at this important conference and the discussions thereon conveniently arranged in three parts. In addition to the opening and closing addresses, the first part includes the papers read by the three guest speakers —Prof. J. Bonner on 'The Biogenesis of Rubber', Prof. G. E. Blackman on 'The Stimulation of Latex Flow by Plant Growth Regulators' and Prof. G. Gee on 'New Methods of Elastomer Synthesis and their Impact on Natural Rubber'. Part I also contains an able review by Sir Geoffrey Clay of the 79 papers read at the conference.

Part II, on natural rubber production, contains the contributions on nutrition of the tree, yield stimulation, ecology, breeding and selection, pests and diseases. Preparation and use of natural rubber and latex is dealt with in Part III and includes papers on the chemistry and technology of dry rubber and latex, and on biochemistry, microbiology, microbiology of latex, factory practice and allied subjects.

The aim of research workers in the field of natural rubber production is to lower production costs, improve the quality of the product and devise special forms of rubber to extend its use. These papers provide ample evidence that the natural rubber industry is well equipped through organised fundamental research and technical development to meet the challenge of synthetic rubbers.

The volume presents a useful survey of modern research work on all aspects of *hevea* rubber production and preparation and provides a most useful book of reference.

D. H. GRIST

FAO Publications

Forestry. 'Methods and Machines Used in North American Nurseries'. Pp. 41. 'Catalogue of Debarking Machines'. Pp. 40. 'Catalogue of Tree-planting Machines'. Pp. 27. Prices not stated.

Forest Workers. Directory of Organisations concerned with Forest Workers' Safety. Pp. 54. Price $0.50 or 3*s.* 6*d.*

Food and Nutrition. Report of the Seminar on Problems of Food and Nutrition in Africa South of the Sahara. Pp. 95. Price $1 or 5*s.*

Soil Erosion by Wind and Measures for its Control on Agricultural Lands. Pp. 87. Illus. Price $1 or 5*s.*

The Grass Cover of Africa. Pp. 168. Map of the grass cover of Africa printed separately. Price $2.50 or 12*s.* 6*d.*

Farm Implements for Arid and Tropical Regions. Pp. 156. Illus. Price $1.50 or 7*s.* 6*d.*

MACHINERY AND EQUIPMENT at This Year's Royal Show—2

Water by wind power—Mechanised bale handling—Liquid manuring—Fork lift trucks—Small power units—Small sprayers—Powerful new trench digger.

IT may interest our overseas readers to learn what is involved in staging an agricultural show on the scale of the Royal Agricultural Show of England. The total area covered by the Show was 170 acres, but in addition 125 acres adjoining the showground were used as car parks. The Grand Ring (one of several) covered 3½ acres.

On the eve of the opening it was disclosed that the 1960 Show had resulted in a considerable loss—nearly £12,000. By holding the Show again on the same ground it is hoped to save £40,000, and perhaps more, before moving to a permanent showground in Warwickshire.

There are about 10 miles of water mains which supplied water to 400 points at 15,000 gal. per hour. There were 4½ miles of sheds and pens for livestock and 1¾ miles of implement sheds.

Once again the working demonstrations provided the biggest attraction in the machinery section. The site, now 16 acres in extent, provided room for live demonstrations of the latest farming techniques.

In the farm machinery lines, it was apparent that bulk handling, not only of cereals, but also of bales, sacks and crated goods, is receiving increasing attention. Hydraulics are being used more and more in these systems and in agricultural machinery generally.

Irrigation promises to play an increasing part in agriculture throughout the world in the next few years, but it still remains to be seen whether organic irrigation (see WORLD CROPS 1961, **12**, 311) will be accepted in this country as it already is in Switzerland.

Continuing our review of the exhibits in the machinery and equipment section, the following is a further short account of exhibits that caught the eye.

'Climax' windmill and tower tank

C

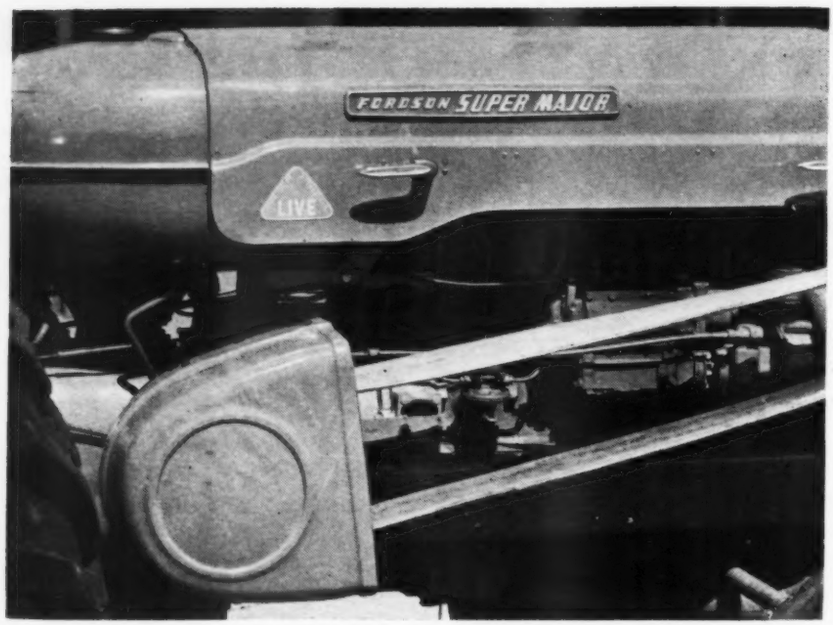
Shoulder-carried sprayer

Our representative was interested to learn of the big demand for the 'Hawk' water-bottle type of hand sprayer which was well to the fore on the stand of *Cooper, Pegler & Co. Ltd.* The container is of 1-gal. capacity, convenient for carrying on the shoulder, and the spray is applied to the crop under pressure through a hand-lance. A similar but even smaller sprayer is the lightweight 'Plafog', a plastic pressure bottle with a capacity of ½ gal. Both these inexpensive units should meet the requirements of the smallholder. Their compact 'Hurricane' motorised knapsack sprayer was used under operating conditions and found to be comfortable to wear and free from engine vibration. It is a duster and mistblower for the application of concentrated insecticides and fungicides at low volume.

F

On the stand of *Gordon Felber & Co. Ltd.* was to be seen the new 'Ideal Rothery' grain cleaner which not only won a Silver Medal award, but also was awarded a Reserve for the Burke Challenge Trophy for new implements. The unit is powered by a *Clinton* 'Gem' 3-h.p. engine.

A 16-ft. galvanised metal tube carries inside it a helically-bladed screw conveyor of floating construction. The upper 8 ft. of the tube is perforated to provide a screen, below which is fitted a trough for the removal of dross, weed seeds etc. ejected through the screen. Cleaned grain is carried to the top end of the cleaner, from which it drops into a blower unit for the separation of seconds, straw, chaff etc.



The new belt pulley guard designed for the Fordson 'Super Major' and 'Dexta' tractors

The *Ford Motor Co. Ltd.* introduced a novel idea—a mobile unit for giving instruction in mechanised farming at shows and agricultural colleges and demonstrations at Young Farmers' Clubs. Basically, the unit consisted of an articulated six-cylinder diesel 'Thames Trader' truck, which is fitted with a built-in cinema as an aid to instruction and is extendible so as to provide a lecture room with a seating capacity for 20 people. The unit will carry 'Super Major' and 'Dexta' tractor units, tractor parts for instruction and a set of servicing tools.

A new safety feature—a belt pulley guard—suitable for the 'Super Major' and 'Dexta' tractors was also shown. This new feature is to be standard for all their tractors supplied with belt pulleys for the British market and will be optional for the export models. When using the guard different belt angles can be obtained by manipulating the attachment bolts and positioning the guard at the required angle. This fitting will be an essential extra where the tractor is used for such operations as husking padi, shelling groundnuts or cutting chaff or root crops, particularly where the workers wear loose clothing.

G

Fork-lift trucks

The fork-lift truck is already an essential tool of the mushroom grower, the market gardener and the florist. *Geest Industries Ltd.* were demonstrating simple handling methods using their trucks, palettes and interlocking stillages for saving time and labour in moving large numbers of pot plants from place to place. The cut bloom stillages were particularly interesting, as they are designed to hold the branches of flowers upright in 16 separate compartments, with provision for drainage, and they can be stacked one above the other for moving large quantities of flowers at a time without damage to the packing sheds. These units also have a place in research for organising pot trials with many treatments and combinations of treatments.

M

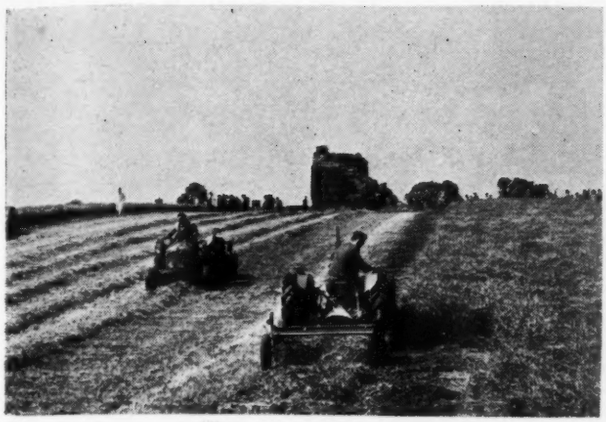
It was announced at the Show that a new company, *Massey-Ferguson-Butler Ltd.*, is being formed to market a range of grain-handling, drying and storage facilities, bulk feed bins and farm buildings in the U.K. and in overseas countries for all cereal crops, including rice and maize.

N

The *New Holland Machine Co. Ltd.* had a comprehensive exhibit, including the 'Super Hayliner' '68' baler, the Model '50' bale-thrower, the Model '33' crop chopper and the 401/5 crimper. The last item consists of two inter-meshing corrugated rollers, one being chain-driven and the other being turned by the bottom roller. The action of this crimper is to kink the stems of the grass every 2 or 3 in., so allowing the inner stem moisture to evaporate more quickly. The result is a light fluffy swath which dries very quickly indeed. Grass crimped in the morning can be baled in the same afternoon. This reduces the risk of weather damage and gives a more nutritious product.

The bale-thrower is a new attachment to the 'Hayliner' '68' baler, which can cut down the time spent on bale handling by 50%, so it is claimed. The range of throw is from 30-36 ft., with a maximum height of 12 ft.

Geest fork-lift truck for market gardeners, research workers and florists



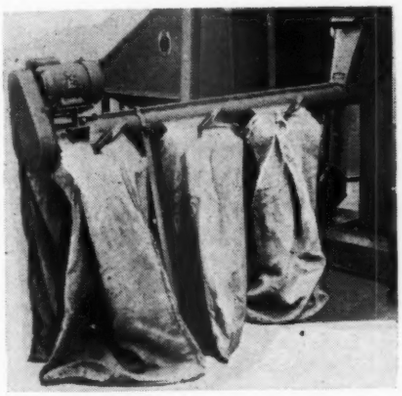
Left: *The mid-mounted Geo. W. King 'Raspee' mower working in combination with a New Holland crimper.* Right: *The New Holland Model 50 bale thrower has a throw of 30-36 ft. with a maximum height of 12 ft.*

Trebled production

The *Nuffield* stand this year was of more than usual interest in view of the building of the British Motor Corporation's new factory at Bathgate in Scotland, to which all tractor production is being transferred from Oxford with a view to trebling present production. The Corporation had 16 tractors on show with a variety of optional equipment; there were eight Nuffield 'Three' and eight Nuffield 'Four', one of each being fully sectioned to show operational details.

The Nuffield 'Three' tractors were shown with the following attachments: *Twose* spring tine cultivator; *Gray's* loader, EMO60 rotavator, *Ransome's* slasher, 'Rotoflail' forage harvester, *Ransome's* reversible disk plough and a *Salopian-Huard* reversible plough.

The eight Nuffield 'Four' models had the following attachments: the *Parmiter* harrow, *Horndraulic* loader, *Russell's* transplanter, *McConnel* ditcher, *Sellars* three-furrow plough, a 'Rearloda' and a *Petit* trailer.



The Scot Mec auger 'Multidischarge' has six bagging-off points

A Fordson 'Super Major' tractor carrying and powering the Howard trencher and pipelayer. The Howard 66 is a larger machine than this

R

A last-minute addition to the exhibits on the stand of *Rotary Hoes Ltd.*, which only arrived on opening day, was the Howard 'Super 66' trench digger. This powerful machine, it was explained to our representative, is primarily designed for use in fen and marsh, where there is very little natural fall to the land and a wide variation in trench depths is required. The digging rotor is mounted within a frame which allows vertical movement for depth adjustment and this is controlled hydraulically. The maximum depth of work is 66 in.; its average working speed is 600-1,000 ft. per hour and it has cut over 8,000 ft. in a day during its proving trials.

S

The *Scot Mec* combined hammer mill and feed mixer was shown fitted with a new type of auger discharge which has six bagging-off points so that the mixer can be emptied in a few minutes under dust-free conditions.

T

Water by wind power

Windmills provide a cheap and inexpensive way of obtaining water from deep wells up to 400 ft. for farms, estates, plantations, remote forest settlements and agricultural centres; they are also widely used for irrigation and water removal. Complete installations can be supplied by *Thomas & Son*, who informed our representative that they have supplied no less than

25,000 of their machines to all parts of the world.

Silent power was demonstrated by one of their tower units, which responded to the lightest breeze and continued merrily pumping and repumping water for the duration of the Show. Units are supplied with 6-, 8-, 10-, 12-, 14-, 16- and 18-ft. windwheels and, while the millhead is so designed that it will respond to the lightest breeze, the actual amount of water delivered in gal. per hour will depend, naturally, on the size of the mill, the diameter of the lifting cylinder and the total head in feet. As a general guide, a 12-ft. windmill will commence pumping in a breeze of 6-7 m.p.h.

V

New power units

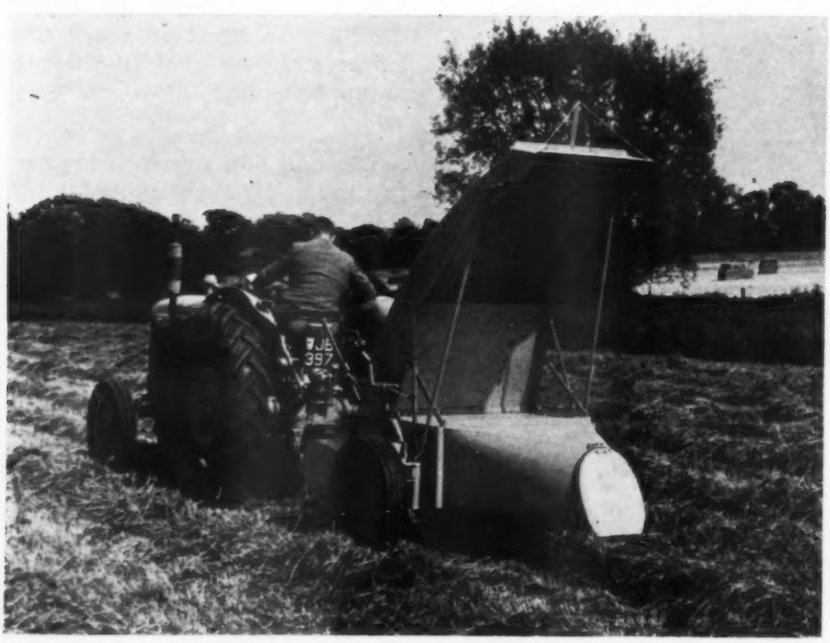
Two new lightweight four-stroke engines have been produced by the *Villiers Engineering Co. Ltd.* for manufacturers of powered farm implements: one is a 75-c.c. unit and the other a 150-c.c. unit. The former will develop up to 1¼ b.h.p. at 4,000 r.p.m. and the other 3 b.h.p. at 3,500 r.p.m. Recoil or rope-and-pulley starting is optional.

W

Whitlock Bros. Ltd. gave prominence to grain-handling equipment on their stand and presented a complete working unit consisting of a pre-cleaner, grain elevators and grain silos. The Linde F8 pre-cleaner shown could deal with 8-10 tons per hour, removing leaves, straw and dust and keeping pace with the production from two or three harvester combines, depending on their size. Their rear-borne transport boxes, which can carry from 8-15 cwt. at a time, depending on the material, can be fitted to the three-point linkage of a tractor, and raised or lowered hydraulically.

John Wilder Ltd. exhibited two new introductions—a new hay chute which can be fitted to all models of the 'Sila-Masta' and a new type of silage chute, made of steel, with a wide delivery. When the weather is dull but windy, hay will dry quicker when it is laid as a high narrow swath by this new device. Other exhibits were the 'Coypu' grain protector, which gives warning of over-heating; the Wilder-Rainthorpe 40-in. flail-type forage harvester with the swivel head for side or rear delivery, the same harvester fitted with special times for pulverising potato haulms, and a special attachment for harvesting maize.

An attachment for the Merry Tiller which would be particularly useful for the collection of light crops and the movement of potted plants



A new device by John Wilder Ltd. for arranging hay in a mounded swath so as to hasten drying

The 'Merry Tiller', fitted with a variety of implements, was the main feature of the stand of *Wolseley Engineering Ltd.* The horticultural model has adjustable handles and is equipped with three sets of slasher rotors. It provides a digging depth of 12 in. along a path 33 in. wide. It was announced that this machine can now be supplied with a self-starter. Wolseley electric fencing—both mains and battery operated—were also exhibited. Their new truck attachment would appear to be suitable for crop collection on tea and coffee plantation on steep hillsides.

The great manoeuvrability of the truck is its most important feature. The operator can assist it along by pushing or pulling it up very steep slopes, or he can walk beside it or sit on the truck.

Agricultural Chemicals and Supplies

Plastics for Agriculture

Plastics in the Garden

The use of plastic films in horticulture were demonstrated by the *Commercial Plastics Group of Companies* at the International Plastics Exhibition. *British Celanese Ltd.* were showing a new wire-reinforced plastics film for cloches, greenhouses and cold frames, and spade handles made from plastic were seen for the first time. The material used is polypropylene, a lightweight material, which is also tough and resistant to abrasion. This is produced by the *United Ebonite & Lorival Ltd.*

Greenhouse of plastic sheet on a framework of Dexion slotted angle

Bouncing Barrels

Another feature at the Exhibition was a demonstration of the latest techniques in plastics fabrication, known as blow-moulding. This is a new method of producing plastic drums, containers, liners, air ducting, buckets and bins complete with lids by directing a stream of air into an extruded tube of plastic inside the appropriate mould. Machines for the new process to cover capacities from 1 pint to 53 gal. are being produced by *Emerson Walker Ltd.*

Fabric Tanks for the Farm

A revolutionary method for handling fuel oil, petrol, vegetable oils, liquid fertilisers, spray liquids and water is by means of the new 'Pillow' tanks, which are made of finely woven nylon fabric impregnated with a coating of compounded rubber. This provides a rugged one-piece unit for either simple storage or the transportation of liquids, *e.g.* coconut oil, palm oil or latex. When empty they can be rolled up and returned for refilling. As portable containers they can be carried in lorries, on flat-top tractor trailers or even on sledges and so used for the transportation of liquids.

They are offered by the *Goodyear Co.* in eight small sizes from 60-350 gal. The latter weighs only 50 lb. when empty and the smallest only 20 lb. These smaller tanks are rugged enough to be lifted and loaded by sling when they are full. Each is supplied with tie-down straps and fitted with a special coupling for hose connections. Large transportation types, available in sizes from 600-6,000 gal., are designed for carrying liquids in small trucks and lorries, which could not otherwise carry liquids.

Modern Potato Packaging

The easier and cleaner handling of potatoes and their better presentation to the customer has been made possible by introduction of *Bakelite* polyethylene bags. The modern method of handling this dirty crop is as follows:

On arrival at the packing station the potatoes are emptied from the sacks into a flume of running water which carries them along to the soaking tank. They are elevated and fed continuously into a roller scrubber and then on to a sponge drier. The clean, dry potatoes can then be sorted and any defective ones can be seen and removed for use as pig feed. The selected potatoes can also be graded for size if so required and the belts then pass on under a spray of a non-toxic sprout inhibitor to the automatic bagging, weighing and sealing machines.

The final result is a very attractive presentation which will appeal to the shopkeeper, because his shop will be cleaner and there is no handling and weighing of a dirty product. The customer can see what he is getting and the potatoes can be prepared for the table with the minimum of mess and dirt.

Crop Protection with Plastic Sheet

Faced with the problem of protecting strawberries from insect pests, a French fruit grower has built himself a greenhouse by erecting a framework of *Dexion* slotted angle and covering it with woven plastic sheet. This sheet permits the free entry of air and rain water whilst keeping out insects.

This material was chosen for the framework because it can be cut to size and the pieces bolted together and the framework can be dismantled or modified at any time.

Granular Herbicide

A new form of weed and grass killer has been introduced by the *Chipman Chemical Co. Ltd.* 'Chlorea Granular' contains sodium chlorate, sodium borate, 2,4-D and Telvar W and this powerful combination is sold in the form of dry pellets ready for use without any need for adding water or dissolving it in water. Not only is it simple to apply, but there is no need to carry large quantities of water and there is no drift or dust problem. On slopes where run-off due to heavy rain may occur care is necessary in order to

avoid killing desirable trees, shrubs or flowers.

This is a non-selective or general weedkiller which will kill deep-rooted perennials, shallow-rooted grasses and annual weeds and its effect is long-lasting. Of very low toxicity, it is non-hazardous to mammals when used according to instructions. Its purpose is to remove undesirable vegetation which may create a fire hazard around estate factories or be a nuisance to good maintenance of estate roads and field paths or narrow-gauge railways on sugar plantations.

Timborised Timber

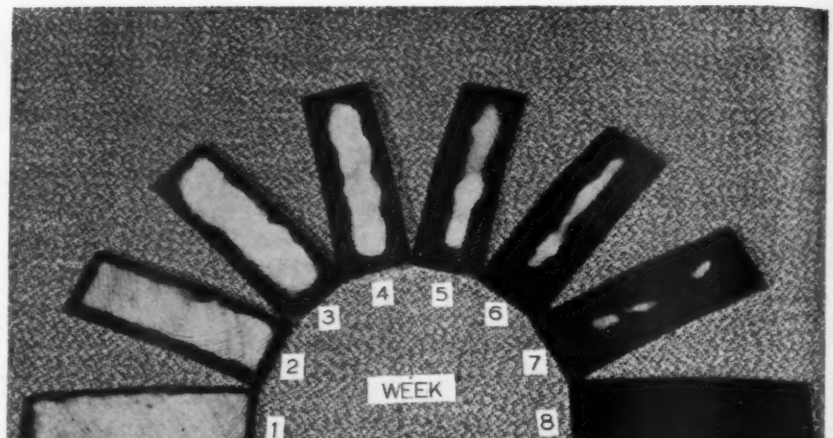
In Australia boron has been used as a timber preservative for well over 20 years, but in the early days the timber had to be immersed in the solution for very long periods to absorb an adequate quantity of the toxic preservative. The New Zealand Forest Service then developed a diffusion treatment which made possible the use of high solution strengths with momentary immersion of the timber in the solution.

Borax Consolidated Ltd. have completed this work by producing 'Timbor', a new form of boron of high solubility, especially for timber preservation. The method of applying it is by diffusion impregnation. The preservative penetrates right through the full cross-section of timbers up to 3 in. in thickness. This ensures complete preservative protection; whatever machining or cutting of the timbers may subsequently be done during fabrication or fixing, the preservative protection is not in any way impaired.

With boron-treated timber all the usual methods of finishing timber can be practised and there are no difficulties in machining, gluing or painting.

Timber treated with borates is now used extensively in New Zealand. In that country last year 3.4 million lb. of boron compounds were used in the preservation of timber, compared with 2.5 million lb. of all other types of preservatives added together.

'Timbor' is supplied as a white, free-flowing powder in bags, ready to put into solution at the treatment plant. It is fully toxic to fungal decay and insect attack, but is harmless to humans and animals. Thus after drying it is ready for use without further treatment.



Sections taken from a 6-in. x 2-in. redwood board showing the progress of diffusion week by week by reagent spot testing. The reagents produce a red colour where 'Timbor' is present and remain yellow in the zone into which it has not penetrated

New Wood Preservation Technique

A new technique for impregnating wood deeply and evenly with a preservative without pressure impregnation, dipping or spraying has been developed. The material used is an organic solvent preservative in the form of a thick emulsion which is applied to timber in bands or ribbons or as an overall coating. These applications constitute a reservoir on the surface of the wood, from which the preservative is gradually absorbed over a period of time.

The material, known as 'Woodtreat-55', contains pentachlorophenol and dieldrin and so is effective both against fungus and wood-boring insects. It has been successfully used for several years in the U.S.A. for the extermination of termites and more recently in East Africa. In the U.K. it is being used against dry rot, woodworm, furniture beetle, death watch beetle and other timber pests.

The product was conceived in the U.S.A., where it was developed by the *Wood Treating Chemicals Co.* In addition to this research, further trials have been carried out for two years by *Preservation Developments Ltd.* in the U.K. and the product is now in full production for sale both at home and overseas.

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Reader Service,
WORLD CROPS,
Leonard Hill House,
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England

Quick-Acting Soluble Slag

Because basic slag has traditionally been applied in winter, it has been regarded as a rather slow-acting fertiliser. Actually a high-grade soluble slag can act very quickly indeed, providing it can get into the soil, and at no time can this occur more readily than when the sward is 'open' after the grass has been cut for hay or silage. The slag can then dissolve while the 'aftermath' is growing, and the dressing does not interfere with the normal stocking of the pastures, either in summer or winter.

To maintain the phosphate level of the soil most grassland needs a dressing of basic slag every three years, at the rate of 6-10 cwt. per acre, in addition to the compound fertilisers used in spring for hay and silage, according to a recent report from *Fisons Fertilisers Ltd.*

World Crop Reports

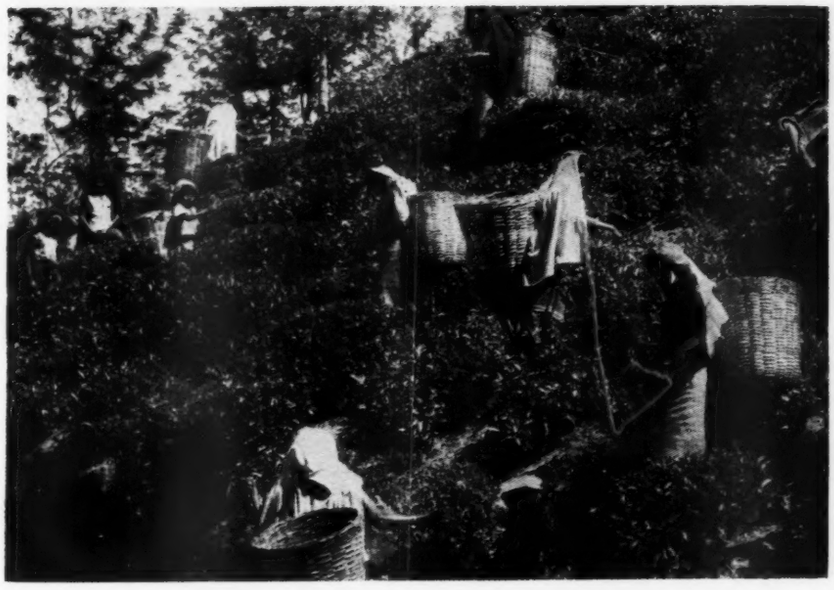
INTERNATIONAL REPORTS

Export quotas for cocoa

A draft agreement on export quotas for the stabilisation of cocoa prices was prepared at a meeting at FAO headquarters in June.

The agreement gives the basic export quotas proposed, which can be adjusted as frequently as necessary in the light of the market situation. It is proposed that an International Cocoa Council is to be set up to administer the agreement, exporting and importing countries being equally represented. An International Cocoa Fund is to be created to finance measures to promote increased consumption and to assist producing countries in meeting the costs of holding stocks above the prescribed quotas.

The draft, as prepared by the committee, was sent to all countries who are members of the Cocoa Study Group for their views.



Plucking tea on an up-country estate in Ceylon

Tea

The 1961 world tea crop is estimated at 2,123 million lb. This will be a record and 3.8% above the 2,046 million lb. of 1960. While the largest increase by continents was in Asia, the percentage rise in South America and Africa was most pronounced.

The sharp upward trend in *South America* is likely to continue. Production in *Argentina* is expected to rise substantially within another year or two due to expanded acreage. *Peru's* acreage has gradually expanded, and acreage in *Brazil* has been relatively steady for a number of years.

Most of the tea-producing countries of *Africa* also are expected to increase their production. Plantings have increased at a steady rate during the post-war period. *Kenya* expects to produce 32.5 million lb. of tea in 1961, compared with only 15 million lb. for the 1950-54 period. A good flush of tea is reported in *Rhodesia* and *Nyasaland*, where exports hit a record in 1960. Southern Rhodesia's output is expected to increase considerably in the next decade, as much money is being invested in the industry and the rate of expansion is rapid.

In *Asia*, where nearly 95% of the world tea is still being produced, the increase in output has been more gradual.

India's 1961 tea crop is estimated at 725 million lb. The 1960 crop declined to 696 million from 716 million of the previous year. The short crop in 1960 was due primarily to smaller output in North-East India. This was partially offset by a slight increase in the total crop in South India.

Ceylon's production, estimated at 450 million lb in 1961, is slightly above the previous record of 433 million in 1960. Tea acreage in Ceylon has changed little in recent years.

Indonesia's 1961 production will probably be about the same as in 1960 at about 100 million lb. The Government estates in Indonesia have production quotas which are quantitative and not on the basis of quality; smallholders' production has not been as large as previously estimated.

Japan's 1961 tea crop is estimated at 185 million lb. The 1960 crop was below 1959, due mostly to drought during the winter and damage to the tea plants by the 1959 typhoon.

Cottonseed

World production of cottonseed in the marketing year beginning August 1960 is estimated at a record 22.9 million short tons, slightly larger than the previous record of 1959 and almost one-quarter above the 1950-54 average. Major increases in India and Mexico more than offset the moderate declines in Mainland China and U.S.S.R., which together produce one-third of the world's cotton. U.S. production was slightly lower than in the previous year.

North American cottonseed production increased slightly in 1960 because of cotton acreage expansion from the low levels of 1959 in *Mexico* and *Central America*, resulting in part from higher prices paid to farmers and more liberal production credit. *U.S.* production was 2% less than in 1959 and the average yield per harvested acre was 24 lb. less than in 1959. The U.S.A. is the world's largest producer, accounting each year for about one-quarter of the world total.

Cottonseed production in *South America* is slightly higher because of expansion in *Argentina*. Following the decline in 1959, Argentine acreage was back to a more normal level in 1960. And, with more favourable weather, production increased about one-third from the previous year. Cottonseed output in *Brazil*, *Peru* and *Colombia* is at about the same level as a year ago.

The relatively small cottonseed production in *Europe* was slightly less than in 1959 with the decline in *Spain* virtually offset by the increase in

Greece. Production in U.S.S.R. dropped 7% as a result of a late cold spring and rather poor harvesting conditions.

African cottonseed production in 1960 also was slightly smaller than a year earlier. However, sharp reductions in *Sudan* and the *Congo* were partially offset by the moderate increase in *Egypt*, which resulted from increased acreage. Sudan and Egypt produce about two-thirds of all the cottonseed grown in Africa.

Cottonseed production in *Asia* was about 4% larger than in 1959. India's out-turn was up one-third from the unusually small production of 1959 despite a decline in acreage for the second successive year. The yield per acre was higher than in the previous year and the 1950-54 average. While cottonseed is a potential source of edible fat, its use in the diet of the Indian people is negligible because the bulk of the seed is fed to cattle.

Mainland *China's* cottonseed output is believed to have declined about 6% for the second successive year as a result of unfavourable weather and insect damage.

Barley and oats

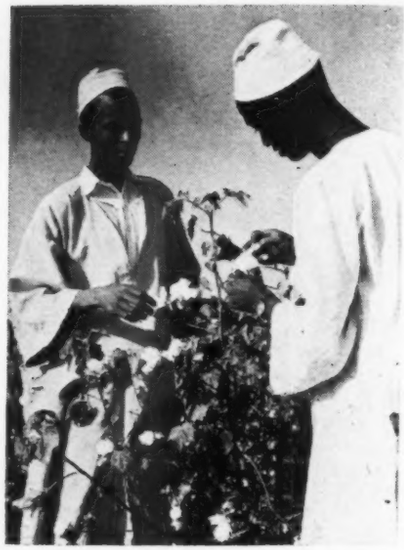
A near-record world crop of barley and oats in 1960 has been confirmed. The combined production is now estimated at 146 million short tons, slightly below the 1956 record.

The record barley crop was the principal factor in the large production. The estimated 3,410 million bushels is slightly above the previous record in 1956. Oats production of 4,000 million bushels, though well above the small 1959 out-turn, is still below average.

The principal areas contributing to the high barley out-turn are *North America*, *Western Europe*, *U.S.S.R.* and *Australia*. Oats production was above average only in U.S.S.R., South America and Australia.

Raisins

The 1960 world raisin pack is even smaller than was previously forecast and is now estimated at 444,800 short tons—the smallest pack since 1950. Since November 1960 estimates have been reduced for *Greece*, *Iran*, *Turkey* and the *U.S.A.* Compared with average, the 1960 pack was drastically lower in Greece, substantially lower in *Australia* and Iran, slightly lower in the *U.S.A.* and slightly higher in Turkey. Preliminary estimates for 1961 indicate a slightly larger pack in *Australia* and a small pack in *South Africa*.



Cotton is one of the cash crops now being grown in Northern Nigeria

REGIONAL REPORTS

Mexico

Preliminary reports on *cotton* acreage planted in Mexico indicate a small decrease in Mexican cotton production in 1961.

The area planted is reported at about 2,100,000 acres, nearly 6% below the 2.2 million of 1960. Acreage declines are expected in all major regions, led by a 67,000-acre drop in Matamoros as a result of some shifting to corn and sorghum, 50,000 acres in Sinaloa due to high production costs and low returns from the 1960 crop, and 24,000 acres in the Laguna region because of a shortage of irrigation water. These declines are partly offset by an expected acreage increase in the state of Sonora, while the acreage in other regions is unchanged.

Early Government and commercial estimates place the 1961 Mexican crop at about 2 million bales, compared with the 1960 harvest of 2.1 million. The crop, now approaching the fruiting stage in early areas, is making good progress, although insects are beginning to appear.

Philippines

Maguey fibre production in the Philippines in 1959-60 was 19% below the previous year. Acreage fell from 9,140 acres to 6,970, and production from 5,732 thousand lb. to 4,630 thousand. Although the crop was all used in domestic manufacture of rope, twine, rugs and mats, production is not expected to increase in the next few years. Output of maguey is small compared with abaca—the principal fibre crop of the Philippines.

Brazil

Brazilian *groundnut* production in 1961 is unofficially forecast at a record 535,000 short tons (unshelled basis), an increase of 25% over 1960. About 95% of the crop is produced in the state of Sao Paulo, where two crops are harvested each year—a wet-season crop in January and February and a dry-season crop in May and June.

The larger forecasted output will result from a projected acreage expansion of about 15% and an expected 10% increase in yields. The larger acreage, primarily in the wet-season crop, resulted from high prices producers received for the 1960 crop. The increase in yields from last year's drought-reduced level was also in the wet-season crop.

South Africa

The final production figure for *sugar* from South Africa for the 1960-61 season remains unchanged at 1.05 million short tons. In the case of Union mills, the sugar was made from 8.65 million short tons of cane. This gives a cane to sugar ratio of 8.70, compared with 8.75 last season. Total production of sugar in 1959-60 was 1.06 million short tons.

Yugoslavia

Favourable weather has greatly benefited Yugoslavia's 1960 sour and sweet *cherry* crops.

Sour cherry production is unofficially estimated at 35,000 short tons, compared with 31,000 in 1960. These estimates include the Maraska sour cherry harvest, which is expected to be an average crop about the size of last year's 2,200-ton out-turn. Sweet cherry production is unofficially estimated at 66,000 tons, compared with 50,000 last year.

Yugoslav exports of dried Maraska sour cherries from January to September 1960 amounted to 82 tons, compared with 187 in the same period of 1959.

Acknowledgment is made to *For. Crops & Mark.* for much of the information contained in the above reports.